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## THE OCTROI AT ISSOIRE: A CITY MADE RICH BY TAXATION.

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IF you look on a good map of France, you will find, a little south of the center, a small, squarish area, painted red, and bearing the name of Puy-de-Dôme. This Puy-de-Dôme is a strange region, made up of fertile valleys separated from each other by ragged hills which were once volcanoes in Palæozoic times. These volcanoes have long since retired from active life, and are black and dismal now, their faces scored by lava-furrows, like gigantic tear-stains dried on their rugged cheeks. In their craters are ponds of black water full of perch and trout—as black as the rocks above which they swim. The highest of these hills the people call the Puy-de-Dôme—the Cathedral-peak. There is an observatory on the top of it, and all the country that you can see from the mountain-summit makes up the "department" of Puy-de-Dôme.

On the south side of the department, near what one might call the "county line," you will find, if your map is a good one, the little city of Issoire. Issoire is a very old town. The Romans knew it. They found it when they invaded Gaul, 1900 years ago, and they called it Iciodorum. They found it again in the year 287, when they came up to convert the Gauls to Christianity, a thing which they had neglected to do upon their first visit. The Romans brought with them a pious monk, St. Austremoine by name, and the people of Iciodorum captured him, and he was duly roasted in accordance with their heathenish customs. So, as the blood of the martyrs is the seed of the Church, Issoire came in

time to be famous as having the largest church and the best parish schools in the whole province of Auvergne.

Issoire has a long, long history, which is duly set forth in Joanne's "Guide-Book," but which I have luckily forgotten. Its story is one of castles and robbers and chivalry, with here and there a fair dame and an ancestral ghost, perhaps, but of this I am not so certain. Once Issoire fell into the hands of the famous knight, Pierre Diablenoir, the Duke of Alençon. After plundering all the shops, burning the houses, killing most of the people, and scaring the rest off into the woods, he set up in the public square a large column bearing this simple legend: "Ici fut Issoire!" ("Here was Issoire"). Were it not for this touching forethought, we might be to this day as ignorant of Issoire's location as we are of the site of Troy.

But the years went on, the wars were ended, the rain fell, the birds sang, the grass grew, the people came back, and Issoire arose from its ashes. To-day it is as dull and cozy a town as you will find in all France. It has now, according to Joanne, a population of 6,303 souls, and a considerable trade in grain, shoes, millstones, brandy, and vinegar. The streets of Issoire are narrow, and the houses are crowded closely together, as if struggling to get as near as possible to the church for protection. The city lies in the fertile valley of the little river Couze, surrounded by grain-lands and meadows. Toward the north a long white highway, shaded by poplars, leads out across the meadows and hills toward the larger city of Clermont-Ferrand, the capital of the department of the Puy-de-Dôme. Issoire is inclosed by an old wall, and, where the highway enters the town, it passes through a ponderous gate, which is always closed at night, as if to ward off an attack from some other Duke of Alençon.

I strolled out one midsummer afternoon on the road leading to Clermont. When I came to the city gate I first made the acquaintance of the *octroi*. A little house stands by the side of the gate, and here two or three gendarmes—old soldiers dressed in red coats with blue facings—watch over the industries of the town. Wheelbarrow loads of turnips, baskets of onions or artichokes, wagon-loads of hay, all these come through the city gate, and each pays its toll into the city treasury. One cent is collected for every five cabbage-heads, or ten onions, or twelve turnips, or eight apples, or three bunches of artichokes, and other things pay in proportion. This payment of money is called the octroi. The process of its collection interested me so that I gave up all idea of a tramp across the fields, sat down on an empty nail-keg, and devoted myself to the study of the octroi.

The octroi is an instrument to advance the prosperity of a town by preventing the people from sending their money away.

It is a well-known fact that individuals become poor simply because they spend their money. So with cities. What is true of the individual is doubly true of the community, itself but an aggregation of individuals. Nations, as well as individuals, grow rich by doing their own work. Commerce, as is well known, is a great drain on the resources of a town as of a nation. Now, if in some way we can keep the money of a town within its limits, the town can not fail to grow rich. As Benjamin Franklin once observed, "A penny saved is twopence earned." The great problem in municipal economics is this: How shall we keep the town's money from going out of it? How shall we best discourage buying—especially the buying of articles from dealers outside?

To meet this problem, the wisdom of the fathers devised the octroi.

In view of the prospective introduction of the octroi into America (and I trust that I am violating no confidence in saying that this is the real object of the present visit to Europe on the part of one of America's foremost statesmen), it is worth while to examine carefully its nature and advantages.

Years ago, before the octroi came to Issoire, the city was noted chiefly for the barter of farm products. The farmers used to bring in grains, hides, cheese, and other produce, which they would exchange for clothing, sugar, coffee, tobacco, and the various necessaries of existence. The merchants used to load the grain into wagons which were driven across the country to the city of Clermont. Here the grain was exchanged for clothing, food, and all manner of necessaries and luxuries which were made in Clermont, or which had been brought thither from the great city of Lyons. There were long processions of these wagons, and all through the autumn and winter they went in and out. And the Issoire people were very proud of them, for neither coming nor going were they empty, and the teamsters of Issoire were the most skillful in the whole basin of the Loire.

But the mayor of the city and other thoughtful people saw cause for shame rather than for pride in the condition of Issoire's industries. It was ruinous thus steadily to carry away the wealth of the land and to exchange it for perishable articles. When a wagon-load of boots, for example, had been all worn out, then the boots were gone. The money that had been paid for them was gone, and, so far as Issoire was concerned, it was as much lost as if money and boots had been sunk in the bottom of the sea. The money that was *paid out*, I say. Not so with the money that was *paid in*. If those boots had been bought in Issoire, the money that they cost would still be in town, still be in circulation, and would go from one to another in the way that money is meant to go. This drain must be stopped, and the octroi could stop it. So

it was enacted by the Common Council of Issoire that "whosoever brings a pair of new boots into Issoire shall be compelled to pay ten francs," which was the cost of a pair of boots at Clermont. The purpose of this order was not to raise money, but to have boots made at Issoire, that the wearing out of these necessary articles should not wear out, at the same time, the wealth of the town.

"People will have boots," the mayor said; "they can not afford to bring them in from Clermont, and so they will make them at Issoire, and all the boot-money will remain at home. It is as though, so far as the city is concerned, Issoire gets her boots for nothing. To be sure, Clermont has a good water-power, and her nearness to the mountains makes the price of hides and tan-bark lower, but this has nothing to do with the question. Natural advantages amount to nothing when artificial advantages can be given by a mere stroke of the pen. The laws of political economy are not of universal application. Depend upon the octroi to make all things equal."

A new boot-factory was now built at Issoire, and boots were offered for sale at twenty francs a pair. The cost of boots at Clermont was ten francs, and the octroi charges at the city gate amounted to ten francs more. Buying at twenty francs would save the purchaser a trip to Clermont and back, and, as trade is apt to flow in the direction of least resistance, after a little the Issoire boot industry became fairly established. There was some grumbling at high prices. Some of the laboring classes went barefooted, while the doctor and the schoolmaster put their children into wooden shoes, or sabots, such as peasant children wear. But the mayor and the Common Council took shares in the new factory, and, being members of the company, they got their boots at the old rate, besides having a part in the large dividends which the business soon began to yield. Employment was given to more workmen, who came over from Clermont; the hum of machinery took the place of the creaking of farm-wagons, the rich began to grow richer, the poor went barefooted, and the people of moderate means felt able to run into debt because they lived in a progressive town. The wives of the members of the Common Council bought diamonds, and the members presented the mayor with a gold-headed cane. Soon other boot-factories were started, and still others, though, strangely enough, the more boots were produced, the more barefooted children were seen in the streets.

By and by the tanners decided that they too must ask for help from the octroi. It was as bad, they said, for the factories to send to Clermont for leather as for the merchants to send for boots. In either case, the money went out of the town, and was gone forever. So the octroi was levied on leather as well as on boots.

Then the guild of butchers put in similar claims. To buy raw hides of the herdsmen out on the Puy-de-Dôme was a part of the same suicidal policy. The octroi was therefore assessed on all imported skins. The butchers established their own stock-yards within the city walls, and were saved from the pauper competition of the mountain cattle. Then the mountain herdsmen drove the cattle on to Clermont, and Issoire was left in peace.

But some of the boot-makers complained that this policy was injuring their business by greatly raising the price of hides, whether produced in Issoire or at Clermont. So the mayor sent a letter to the Issoire "Gazette," a long letter which the schoolmaster had helped him to compose, and in which he showed conclusively that the purpose of the octroi was to make things, not dearer, but cheaper. Said he: "The ultimate result of the octroi is always in the end to reduce prices. The sole purpose of the octroi on hides, for example, is to educate our people in the art, so to speak, of raising hides. By this education, they may, by superior intelligence, experience in the business, and the acquirement of knowledge on the subject, be enabled to produce cowhides in such abundance, by new and improved methods, that they may sell them much cheaper than they do now, sell more of them, and yet realize a larger profit on each hide than they can do at present. If there is a fair prospect that this can be accomplished, who shall say that it is not a part of wise statesmanship to attempt this result? Cattle-raising is now carried on in the most primitive way, by driving the cattle about as though they were wild beasts from place to place on remote and uninhabited hills. The octroi will tend to encourage each householder in Issoire to keep his own cow, produce his own leather, thus diversifying his business and giving him some new product to sell every year, some new demand for labor."

And the thoughtful men of Issoire, the leaders of public opinion, saw the force of this argument, and they were satisfied to submit to temporary inconvenience for the sake of the industrial education of the people.

But the boot-trade was already growing slack. The market had supplied boots for all, but the people perversely refused to take them. The shop-windows were full of boots, temptingly displayed in rows of assorted sizes; nevertheless, every person in Issoire, except those engaged in boot-making, seemed bent on wearing his last year's boots rather than pay twenty francs for a new pair. The high price of leather and hides since the exclusion of the mountain cattle began to reduce the profits in boot-making, and so some of the factories threw a poorer article on the market, without, however, any corresponding reduction in price. And people found that it was cheaper to go to Clermont again

for boots, notwithstanding the payment of the octroi. Accordingly, the old wagons were sent out once in a while, by people who had more cupidity than patriotism. And a little coterie of aristocrats who sneered at the mayor as a demagogue, and at the octroi as a "relic of the middle ages," used to wear Clermont-made boots, and to ape Clermont fashions. But all good citizens discouraged this, and the maintenance of the "Issoire idea" became one of their articles of faith, next to those in the catechism.

But Clermont-made boots often came in on the sly—no one knew how—to the dismay of the local dealers. The Common Council saw that this would not do, and that the single old soldier who guarded each of the city gates could not meet all the requirements of the octroi. So at each gate were placed a dozen gendarmes, in red woolen uniforms, with black caps fastened on by a leather band which went around the lower lip. And the gendarmes searched every cart and every ash-barrel that went in or out. They watched every rat-hole in the wall to see if haply, by day or by night, boots should come into Issoire without the chalk-mark of the octroi. Occasionally some poor wretch was taken in the act of throwing boots over the wall, and made to pay the penalty of his crime. But sometimes even the gendarmes themselves, the guardians of the prosperity of the community, were seen walking about in Clermont-made boots, which they had obtained by a process known as "addition, division, and silence." The mayor noticed this one day, but the gendarmes had just presented him with a gold-headed cane. They were very much devoted to the Issoire idea—it was just before election—and on the whole he thought it best to say nothing about it.

The problem now before the mayor and the Common Council was this: How shall we put life into the boot-trade? The stock was large, its quality was excellent, and yet for days at a time the boot-shops would not see a customer. Something must be done. At last, an ordinance was passed that every citizen of Issoire must have at least one new pair of Issoire-made boots, which must be worn on Sunday afternoons when the band played in the park—at which time the gendarmes would go about on a tour of inspection. When Sunday came, half the workingmen stayed at home all day, because they had not the money to meet the requirements of the law.

But a few of the bolder ones went to the mayor and said openly: "If you want us to wear Issoire-made boots, you must furnish them for us. You ought to do it anyhow. This city owes us a living, and we came over here from Clermont to get it. We were told that the workingman in Issoire would have the octroi on his side, and would not have to work like a slave to keep soul and body together, as we had to do at Clermont. But it is the same

old story here. We do all the work, and somebody else gets all the profits. Now we have to buy and pay for the boots we make ourselves. The cowhide in a pair of boots costs the capitalists but a franc, and we, the boot-makers, pay twenty francs for the boots when we have made them. The other nineteen francs are the product of labor, and ought to belong to us. Our boots should be furnished at a franc a pair."

So they held a mass-meeting in the *café* of the Lion d'Or, and resolved that the rights of man were not respected in Issoire. They sent a delegation to the mayor, asking that boots for the workingman be furnished at the expense of the town. This would be but justice, and, moreover, it was the only way to start anew the wheels of industry. Money should not be locked up in the city treasury. It should go from man to man, and this action was sure to set it going.

Then the schoolmaster wrote a long letter to the Issoire "Gazette," and showed very clearly that this claim was on the whole a just one. Nobody understood the argument, but all applauded it because it looked very learned; and, moreover, its conclusions were in harmony with their previous opinions. The schoolmaster showed that, as boots were worth twenty francs a pair, and the leather in them cost but one franc, the nineteen francs left were the product of labor, and should rightfully be returned to the laborer. Now, in Clermont, where boots were made by pauper labor, the boots sold for ten francs, and the leather in each pair was worth but fifty centimes. In Clermont, therefore, the rightful share of labor, even if labor had its due, which it never has in this world, was only nine and a half francs; that is, to labor belonged nine and a half francs on each pair of boots in Clermont, and nineteen francs in Issoire. The lot of the laborer was therefore twice as delightful in Issoire as in Clermont, this difference being due to the beneficent influence of the octroi.

And the Common Council, who were friends of labor, decided that hereafter the price of boots should be twenty francs to workingmen, but that nineteen francs of this should be paid as a bounty from the public treasury. But, "always taking out of a meal-bag and never putting in, soon comes to the bottom," as Benjamin Franklin once said, and there have been few shrewder observers of French politics than he. One morning, when the treasurer put his hand in the strong box to get the nineteen francs to pay for one more pair of boots, he found it empty. There were only a bad franc, a fifty-centime note, and half a dozen copper sous and two-centime pieces; nothing more. He had come to the bottom.

Here was a crisis! The mayor and the Common Council were called together in haste. The workman, Jacques, who wanted the

boots, was waiting outside, a big, burly fellow, with a sledge-hammer fist and an unpleasant look in his eye. The mayor took one glance at him, and saw that he was not to be trifled with. Moreover, this one case was not to end the difficulty. The road to Clermont and the road across the mountains to Aurillac, the chief town of the next department, Cantal, were black with the advancing hosts of workmen coming to share the privileges which Issoire held out to the oppressed of every city. Through the windows of the Hôtel de Ville the mayor could see them coming, and he knew that the demand of each one of them would be "boots." It was not one pair of boots to be paid for, it was a thousand! There were boots enough in Issoire. The factories were never so prosperous, and the money they received from the city was kept in rapid circulation. The grocers got some, the butchers some, a good deal went to the landlady of the Golden Lion, and the wives of the factory-owners and the councilmen bought diamond necklaces and bracelets to match the ear-rings which they had before.

But this could not go on unless the city treasury could meet the demands upon it. In the words of a celebrated economist, "The mill can never grind again with the water that is past," and, unless new water could be procured, grinding was over at Issoire. The town must have money, or else the factories would be closed, the supply of boots cease, and each citizen of Issoire would have to keep the wolf from the door by his own unaided exertions.

It was a great crisis, but such crises, "God's stern winnowers," as the poet calls them, are the making of great men. And this crisis made a great man of the mayor of Issoire, or rather it made a background against which his greatness could be seen. I have forgotten the mayor's name, and I am very sorry for it. It was a French name and wholly unpronounceable to me, something like De Rougeâtre, or De Rousselieu; but if ever the name of a mayor were

"On Fame's eternal beadroll worthy to be filed,"

it is his, and it is my constant regret that I can not file it there.

And the mayor said: "All our prosperity is due to the action of the octroi on a single article of necessity—namely, boots. This is prosperity along a single line only, a one-sided development of our industries, and from this comes our present embarrassment. Put the octroi on everything, and you have prosperity along the whole line. Some of these things we can produce at home, some we can not. Those that we can not produce the people will have somehow, and from these you can raise the money to pay for the boots which Issoire recognizes as the just due of the toiling workingman." Here the mayor wiped a tear from his eye, and raised his voice a little, in the hope that perchance some toiling workingman might be listening outside, or taking his needful midday rest at the Golden Lion, next door.

"On the tea, coffee, pepper, brass, tin, diamonds" (here the Common Council heaved a sigh), "and other articles which Issoire can not produce, we will raise the income which the city needs. And the great charm of this tax is, that the people will not feel it at all, for it will all be paid by outsiders, by these merchants from Clermont and Lyons who send their goods to our town. They own the goods, they bring them here, they pay the octroi, for we need not buy of them until the goods are safe inside the city gates. By a single stroke in financial policy, we shall keep our factories running, our workingmen contented, and make the merchants in our rival cities pay all our expenses. As for the other articles which we buy in Clermont, we can make them here, if only we can have the octroi to help us. Extend the octroi to everything, and Issoire will become a microcosm, a little world within a world. We shall do everything for ourselves. There is no excuse for buying anything in Clermont so long as there is a foot of land in Issoire on which a factory can be built. We shall have woolen-factories, and powder-factories, and iron-foundries, and distilleries, and cotton-factories, and wine-vaults, and chair-factories, and stone-quarries, and gold-mines, and flouring-mills, and paper-mills, and saw-mills, and wind-mills, and gin-mills, and—"

But here the mayor began to grow a little incoherent. He had been out late the night before, explaining the advantages of the octroi at the club in the Café de la Comédie, and his private secretary pulled his coat in warning that he should bring his speech to a close.

The mayor's recommendation was accepted in part. A few of the Council had been in favor of issuing some kind of cheap money—some sort of brass or paper token, which they could make by machinery whenever the treasury became empty. But the majority had seen this kind of money before, and they firmly resisted the suggestion. By way of compromise, they agreed to extend the octroi to twenty-seven articles—mostly articles of food or clothing which had been brought in from Clermont or from the mountains of the Puy-de-Dôme. The workman Jacques was dismissed with a pair of boots, for which the mayor himself paid. Jacques left the council-chamber satisfied, and the crisis was averted.

And now money flowed in again to Issoire. The farmers who brought in onions paid a little, the boy who pulled water-cresses a little, the milkmen a little, the vine-growers a good deal more, but most of all came in from the merchants of Clermont, who in spite of all discouragement still persisted in carrying cheap goods to Issoire.

Prices went up; a sure index of prosperity. It was easy to pay one's debts—easier still to make new ones; but the great thing was

that the money was kept in town. To go from hand to hand, from hand to hand, and then from hand to hand again, as in the endless round of the fairy tale—that is what money is for. Factories sprang up as if by magic, and down the long white highways multitudes of the crushed and down-trodden of other cities were seen tramping along to share the prosperity of Issoire. Five hundred soldiers in red and blue uniforms had taken the place of the dozen gendarmes, the dome of the church was gilded anew, and the poet wrote a sonnet in which Issoire was compared to the island of Calypso, and the mayor to Ulysses.

But the weather was never so pleasant that nobody had the rheumatism. Never was country so happy that the grumblers all kept still. There were some complainers even at Issoire. Those who lived on incomes and endowments said that with the rise of prices it was every day harder to make both ends meet. One wealthy man who wore Clermont-made boots, and had furnished his sons with private tutors, and saddle-horses and gold watches, now found it almost beyond his means to keep them in ordinary clothing. But he soon removed to Clermont, and others of the same sort went with him. With them, too, went the widows and orphans who lived on endowments, and the old soldiers who had government pensions.

But the mayor said: "Let them go; it is a good riddance. They belong to the non-producing class, a class that hangs like a millstone on the neck of labor."

But, in spite of all adverse influences, many people from Issoire visited Clermont in fine weather for pleasure or for trade. It was pleasant to wander about the larger town, the home of their ancestors, to be a part in the bustle of its streets, and to breathe its metropolitan air. There were better opera-houses there and picture-galleries, and there was a special charm in the shops where prices far below those at Issoire were ostentatiously fixed on elaborately displayed wares. And so—almost before the owner knew it—many an Issoire wagon was loaded down with cheap goods from Clermont. But, although the octroi was paid at the city gates, the real purpose of the octroi was evaded. The money, in the first place, was spent outside the city. Worse than this, the octroi, instead of being paid by the agents of the Clermont merchants—as the law intended—was collected, as the mayor of Issoire now said, "off our own people." For, if the octroi is to be collected in this way, "off our own people," it would be just as easy and a good deal cheaper and fairer to collect the tax in the usual way, in direct proportion to the value of each man's income or capital.

Another ordinance was clearly necessary. The wagon-maker at Issoire had long since gone out of the business. The prices of

wood, iron, leather, and paint were such that he could not compete with Clermont manufacturers. So the wagon-shop was closed, and carriages and vehicles of every description were brought over from Clermont. The cost of these vehicles had been a heavy drain upon the resources of Issoire. The octroi alone would not remedy this, for nothing short of absolute prohibition of outside purchase would revive the wagon-trade. So the mayor proposed that by another bold stroke the dying industry should be revived, while at the same time the citizens of Issoire should be prevented from paying the octroi. It was enacted that no citizen of Issoire should own any sort of vehicle—wheelbarrow, cart, wagon, barouche, carriage, or droschke—unless said vehicle was made in all its parts at Issoire, and bore the signature of the mayor and the seal of the Common Council. This saved the city many thousands of francs, for, now that the people no longer drove over to Clermont, the Clermont merchants sent goods to Issoire; and, when they entered the gates, the Clermont people paid the charges of the octroi.

When the first Issoire wagon was finished, the maker had put such a high price upon it that no one would buy, and the reviving industry began to faint again. The wagon-maker said that he couldn't help it. Unless he could in some way get wood and nails at special prices his wagons would be out of the reach of all buyers. A few of the Common Council were in favor of releasing the wagon-maker from the octroi on articles used in the manufacture of wagons, but the rest were unwilling to do this—because to buy these materials outside is another drain on the prosperity of a town. At last they arranged a compromise, by which the city gave an order for a new street-sprinkler and twelve rubbish-carts, to be paid for from the public treasury. They had no need for a new sprinkler then, and five rubbish-carts would have been enough. But a liberal order like this made the wagon-maker contented, and a generous policy was necessary to start anew the wheels of trade, which, in spite of all their care, were frequently becoming clogged.

Once more the treasury was nearly empty. The citizens of Issoire, accustomed to having their taxes paid by the people of Clermont and Lyons, would not submit to any form of direct taxation. Had the Common Council said: "We must have so much money; we propose to take it from your pockets by a *pro rata* assessment," the people would have risen as one man and put the opposition candidates into office. Direct taxation is a confession of barrenness in expedients. Where money is to be raised, it should always be collected from foreigners, if possible. This is a maxim in political science, and all successful financiers from Julius Cæsar down have acted in accordance with it.

The falling off in the Clermont trade, due to the new wagon

law, had made a serious reduction of the revenue. And now appeared the wisdom of the mayor's original suggestion. What Issoire needed was prosperity along the whole line. A partial octroi means only partial prosperity. A universal octroi insures prosperity which is unbounded and universal.

And so the schoolmaster took a copy of Littré's "Unabridged Dictionary" and the "Dictionary of the Academy," and from these he drew up a list of three thousand eight hundred and seventy-two articles on which the city government might levy the octroi. And the mayor and the City Council sat up half the night to decide just how much octroi each one of these articles should bear, in order to secure the best results to the community.

The list began:

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| Absinthe | octroi | one franc per bottle. |
| Accoutrements | " | five francs per set. |
| Acids | " | one franc per litre. |
| Alcohol | " | five francs per litre. |
| Alligators | " | five francs each. |
| Animals (not otherwise specified) | " | ten centimes per kilogramme. |
| Arnica | " | five centimes per kilogramme. |
| Artichokes | " | five centimes each. |

And so on, down to zinc and zoöphytes.

The general effect of this law was like that of a refreshing rain upon a thirsty field. Everybody took heart, and general confidence in the future is the chief element in financial prosperity. But the law had some curious results.

The octroi on elephants was so high as to be prohibitory, and the Italian organ-grinder thanked his stars that he and his monkey were well inside the city gates before the law went into effect. The combined tax on quadrumana and musical instruments was more than he could pay. Once within, however, he enjoyed a full monopoly, and this, so the schoolmaster told him, was just what the law originally intended, for octroi is spelled in Latin "auctoritas," "by authority," an authorized monopoly. The manufacturers of dolls were much encouraged. Christmas was coming on; the children must have dolls; and the pauper doll-makers of Jonas, with whom Saint Nicholas had been in the habit of trading, were by no means able to pay the octroi.

But, on the other hand, the trade in looking-glasses was nearly ruined. The octroi on glass, quicksilver, wood, tin, varnish, and glue, drove the mirror-maker distracted. The people took to polishing up tin pans, and to looking into dark windows or down into deep wells, in search for the truth that is metaphorically said to be lying there. Then the law offered some curious anomalies. For instance, a sheep with the wool on went through the city gates for fifteen francs. If the wool was taken off, it was charged

a franc per pound, and the sheep went in as mutton, paying five francs. It was, therefore, cheaper to take a sheep to pieces outside of the city gate rather than within.

Again, there was a curious complication in the matter of boot-jacks, a humble article of domestic use, manufactured in the little village of Jonas, just mentioned. If these were sent in as household furniture, each paid a franc, while, as wooden-ware, the charge was fifty centimes.

With the millstone-trade the results were even more remarkable. One of the chief articles of export from Issoire, in its early days, was the stone used in flouring-mills. In the lower part of the city, close to the river Couze, there is an extensive quarry of a coarse, hard sandstone, most excellent for milling purposes. It had long been a saying with Issoire people, "We send Clermont the wheat, and the stones to grind it." The Issoire millstones were not inferior to those quarried in Cantal, and, the distance from Clermont being much less, the Issoire millstone-cutters had almost a monopoly of the Clermont trade.

In the early days of the octroi, however, the wagons which had formerly brought over manufactured goods in exchange for millstones were obliged to go to Issoire empty. Thus their owners had to charge for one trip almost the former price of two. This increased cost of transportation brought down the price of millstones in Issoire, for the competition of the quarries of Cantal made it impossible to raise the price at Clermont. To do that would be to divert the trade of the Clermont mill-owners entirely to Cantal. In such cases, the prices for the whole region must be governed by the price at the center of trade. The profits of the Issoire quarry were thus materially reduced. The owners talked of reducing the wages of their employés, but this they could not do, for the wages were already at the lowest point at which effective service could be secured. The natural remedy lay in an appeal to the octroi. The Council levied five centimes per kilogramme on all millstones brought into Issoire. Some of the Council thought this levy an absurdity, for not a single millstone had ever been imported. The old proverb as to "carrying coals to Newcastle" was intended to cover just such cases. But the mayor told them to wait and see, and the result showed his far-seeing wisdom. The quarry-owners doubled their home prices, while the octroi preserved them from loss through outside competition. Then followed one of those curious surprises which lend such zest to the study of French economic problems. The price of millstones at the quarry in Issoire was nearly double the price of the same millstones in Clermont, whither they were carried by salesmen from Issoire. After a time Issoire mill-owners began to send to Clermont for millstones, instead of buying them at home. It was

cheaper for them to buy their home products in another city, to pay carriage both ways, and to pay the octroi at the city gates, than it was to send across the street in Issoire for the same article. Freedom from competition at Issoire enabled the quarry-owners to fix their own prices at home, and thus to broaden the slender margin of profits which came from outside trade. This peculiar condition reached its climax when one of Beltran's wagons from Clermont left Issoire with a load of millstones, while, next day, the same wagon, without unloading, carried the same millstones back to be used in the mills of the Issoire General Company of Flour and Meal! The schoolmaster was ecstatic over the stimulus thus given to several industries at once. It was like killing many birds with one stone. But the Issoire Association for the Home Production of Millstones was not satisfied with Clermont competition, even in this peculiar form, and an increase in the octroi soon put further importations out of the question.

There were also some curious omissions in the list, in spite of its length and complexity. An old woman, Widow Besoin, who lived near the Cantal gate, had five speckled Dominick hens, of which she was very fond. These hens were to her a source of profit as well as pleasure. She came to the mayor with the complaint that her neighbor, Farmer Bois-rouge, who lived just outside the city gate, brought in the eggs of his chickens free, and sold them at prices far below those she was compelled to charge for the eggs of her hens. The Bois-rouge chickens roamed over the whole farm and lived on grasshoppers and gleanings, while hers were fed on grain which had passed the octroi. It seems that the schoolmaster, in making up the octroi list, in arranging the o's had neglected to look for words beginning with "oe," and so had omitted the word "œuf," which is the French for "egg." So the Council was called together, a rate for "œufs" was agreed upon, and Widow Besoin's Dominick hens were free from the pauper competition of the chickens of Farmer Bois-rouge.

But the action of the octroi was, on the whole, as I have said, extremely beneficial. It filled the treasury again, and it stimulated a large number of infant industries, which had previously been unable to compete with established industries in surrounding towns, on account of the high prices of raw materials, and especially of labor, at Issoire. It is true that workman Jacques and some of the other laborers complained that these high wages were high in name only. In Clermont, men worked for three francs a day, but these three francs would buy twelve yards of calico or ten pounds of sugar, while the five francs received in Issoire would buy but ten yards of calico or eight pounds of sugar. But the schoolmaster wrote another letter to the "Gazette," showing that the question of wages was solved by an estimate of

what the laborer saved, not by what he could buy with his wages. "Every workingman," said he, "as statistics show, saves thirty per cent of his wages. In Clermont, therefore, the laborer lays up one franc per day, or three hundred francs per year. In Issoire, he lays up one franc fifty per day, or four hundred and fifty francs per year, a difference of one half in favor of the workman at Issoire as compared with the pauper labor of Clermont."

The workman Jacques read this aloud in the bar-room of the Lion d'Or, and pondered over it a good deal, for the logic was irrefutable, and yet after all these years he had not four hundred and fifty francs which he could call his own.

The mayor made a speech to the workingmen, congratulating them on his re-election, and assuring them that "for them and for them alone the octroi was brought to Issoire. It was the pride of Issoire that its workingmen were princes and not paupers. If they paid high prices for articles of necessity, it was only that they might get higher prices in return. You sell more than you buy, and what you sell, the strength of your own right arms, costs you nothing, and, when it is sold, is as much yours as it was before. It is God's bounty to the workingman. If these industries which the octroi has built up around you are left unprotected, you too would be left without defense. In the natural competition of trade, the rich grow richer and the poor poorer. Without the octroi we should behold here as at Clermont the spectacle of the chariot-wheels of Dives throwing dust into the eyes of Lazarus. But here in Issoire, Lazarus is, so to speak, already in Abraham's bosom. The workingmen of Issoire have no truer friend than Issoire's mayor, and to cherish their interests is the dream by day and by night of Issoire's Common Council."

But we must return to the boot-trade, on which the octroi was first established. The history of that industry is the history of all the others, for in one way or another all experienced the same changes and conditions.

The profits were large at first, and very soon the Issoire Citizens' Foot-wear Manufacturing Association had no longer a monopoly in boots and shoes. The original concern still retained the city contract for supplying boots to the laboring-men, but the others found the general trade no less profitable.

But soon an unexpected decline in boot consumption took place. People perversely wore their old boots, which had long passed the season of presentability. The children went barefooted or shuffled around in sabots. Even worse, many parents bought for their children a new kind of copper-toed shoe, which was made in Clermont—a shoe that could never wear out at all; one of the worst possible things for the shoe-trade in any country!

When it was found that boots and shoes enough to last for five

years were for sale in the shops, it was evident that something must be done. The original concern decided to wait. It closed its factory and discharged its workmen. But some of the other firms could not wait. They must have their money back or go into bankruptcy. Shoes began to come down. Every shoe-dealer was alarmed, and a meeting was held in the Café de la Comédie to see what could be done. It was decided to lower the prices and then to maintain them. Boots were rated at fifteen francs per pair, and shoes and slippers in proportion. But one dealer could not keep his promise. He had a very large and handsome new shop, and he had spent much money in fitting it up. A gentleman, named Shylock, from whom he had borrowed the money, said that he had lent money for legitimate business, not for speculation; to sell shoes, not to hold them for higher prices. This stock of boots was thus forced on the market, to be sold for what it would bring. And other dealers had to sell for similar prices, or lose all chance of selling at all. And so Issoire was full of notices:

"GRAND SLAUGHTER OF BOOTS AND SHOES!"

"BOOTS GIVEN AWAY—ONLY FIVE FRANCS A PAIR!"

Boots were never so cheap before, in Issoire or anywhere else in France.

The Issoire Citizens' Foot-wear Manufacturing Company took no part in these cheap sales. Its agents were active, however, and they privately bought up a part of the stock of the smaller stores, and sent out several wagon-loads across the country to Clermont, and one down the river to the farmers in the valley of the Loire.

It was an era of cheap boots. Everybody was well shod. The children burned up their wooden shoes, or used them only for coasting in the winter, and there was general satisfaction. The Minister of Public Instruction, who spent a day in Issoire on his way from Marseilles to Paris, had a pair of new boots presented to him, and he showed them at home, as an example of what the octroi could do for a town. "Boots," said he to the Minister of Finance, "are actually cheaper to-day at Issoire than they are at Paris or Lyons. So much has the octroi done for my countrymen." And the mayor sent a message of congratulation, reminding the people that his promises had come true. "The octroi has reduced the price of boots, and has demonstrated the truth of the paradox that the quickest road to low prices is to make prices high." The traders who had gone into bankruptcy left Issoire and were speedily forgotten—except by their creditors, chief of whom was Monsieur Shylock. It did not much matter about them in any event. Their loss was the community's gain. It was not Issoire's fault that they were dealing on borrowed capital and could not stand the strain of reduced prices.

After the period of congratulation was over, the President of the Issoire Citizens' Foot-wear Manufacturing Association called the heads of a few of the rival houses to his office. They agreed together to ask for an increase in the octroi, in view of the depressed condition of the boot-trade, after which they would, in view of the increase of the octroi, raise the price of boots to twenty-five francs. They formed a new association called the Issoire Equitable Confidence Society, the object of which was to prevent the Clermont dealers from flooding the city with cheap boots, a thing which the latter had been steadily on the watch to accomplish. The Equitable Society took special pains to serve Issoire by regulating the price of boots according to the city's real needs. The city had suffered from overproduction. Now, when any firm outside the Equitable Society tried to resume work, the price of boots was suddenly lowered, until the competing dealer would be willing to sell out on favorable terms to some of the society's members. There were a few dealers in Issoire who still brought boots over from Clermont. These were made to understand that their course of action was unpatriotic, and that it was displeasing to the members of the Equitable Society. The office of the octroi was visited by several men who accused one of these dealers of having silk stockings concealed in an invoice of boots from Clermont. All the boxes were opened and each boot examined. Then all were thrown in a pile by the side of the street. The owner gathered them up as well as he could, but the street boys helped him, and before he knew it several boys and several pairs of boots were missing together. And so in a hundred ways the Equitable Society discouraged outside and inside competition, until at last the entire boot-trade fell into its hands.

But the rise in the cost of boots had its effect on the workingmen. Clearly the increase in the price of boots was due to the growth of labor, for the price of hides was no greater than it was before, while the value of hides made up into boots was materially higher. If a day's work was worth five francs before, nine francs was not too much now when labor was so much more valuable to the capitalist.

The big workman Jacques thought this out, and in the *café* of the Lion d'Or he advised the workingmen to march in a body to the President of the Confidence Society to demand their rights. They did so, with the master-workman Jacques at their head. Their demand was nine francs a day, or no more boots in Issoire. The president had expected this. In fact, he had rather hoped for it; and so he had kept a good stock of boots in reserve for such an emergency.

He spoke very kindly to the deputation, patted Jacques softly on the arm, but, in brief, said that the state of the trade would

permit no increase of wages at present. Next day the doors of the factories were closed, and each workman received his pay in full, and his discharge.

For a week the factories were empty and silent. The Confidence Society was not idle, however, for a trusty messenger had been sent at once to the village of Jonas. He offered four francs a day to the Jonas men if they would come over to work in Issoire. Now, Jonas is a queer little town, built all around the brow of an old volcano. I doubt if there is another like it on earth. The top of the hill is made of hard lava, below which is a belt of ashes, very old and packed solid, but as easy to cut as cheese. Long ago the ancient Gauls burrowed into this hill and filled it with their habitations. These appear like gigantic swallows' nests when you look at the hill from below. One of the largest of these houses is used as a church, and its lava walls are rudely frescoed over in imitation of the big church at Issoire. Only very poor people live in Jonas now, people who can not pay much rent, and who do not mind the absence of fire in the winter. And the Jonas men were glad to come over to Issoire for four francs a day, to take up the work which the pampered laborers of Issoire had refused.

The coming of the Jonas men was a great surprise in Issoire, and gave rise to much hard feeling. The workmen who were idle met them with eggs and cabbages, and some of them even carried bricks. But the gendarmes were on the side of the Confidence Society, and they protected the new men from any serious harm. So the mob followed sulkily in the rear, shouting "Rats! rats!" It sounded like "Rah, rah!" for this is the French way of saying "rats."

Winter was now approaching, and the discharged boot-makers of Issoire found their condition daily more and more unpleasant. They had an association among themselves called the "Chevaliers of Industry." The big Jacques was master-workman, and they met in the *café* of the Lion d'Or to discuss matters of common interest. They had a good deal to say of the power of organized labor, the encroachments of capital, and maintained that the value of all things is due solely to the labor which is put upon it. The so-called raw material, land, air, water, grass, cowhide, shoe-pegs, all these are God's bounty to men. No one should arrogate these to himself, and all should be as free as air. All else in value labor has given. Capital, the interloper, has unjustly taken the lion's share, and left a pittance to labor. What capital has thus taken is ours, for we have made it. Then the speaker referred to the snug little capital which the President of the Confidence Society had laid away in his strong-box, and which shone out through his plate-glass windows and made itself felt in every smirk of his self-satisfied face. Another speaker said that the thief of labor was

the worst of all thieves, and for them to despoil him was but to seek restoration of stolen goods. And the schoolmaster said that he who takes for his own the value labor has given is worse than he who robs upon the public highway—for he adds hypocrisy to theft.

Some of them counseled an immediate attack upon the managers of the Confidence Society, but the voice of master-workman Jacques was for some compromise which would restore them to employment. There had been a considerable fund collected by the Chevaliers of Industry in the way of dues and assessments. This fund he had distributed among the unemployed laborers, freely at first, but of late more sparingly. There were many who hoped to live through the winter on this fund, and these spoke in no pleasant terms of the master-workman's stinginess. The fund was nearly gone, and Jacques well knew that, if work was not soon resumed, the order of Chevaliers of Industry would come to a sudden end. Organized labor without money is very soon disorganized.

A few heeded his words of counsel and followed his lead to their homes. But the bolder spirits stiffened their resolve with the wines for which the *café du Lion d'Or* is so justly famous, and started for the residence of the President of the Confidence Society. They roused him from his bed, killed one of the Jonas men whom they found asleep at his door, insisted on an immediate division of his personal property—which he was only too willing to grant—and next morning they found themselves in jail, charged with robbery and murder.

There was again excitement at Issoire. The workingmen held mass-meetings at the Lion d'Or, and passed resolutions of sympathy and defiance. The wives and daughters of the members of the Common Council sent bouquets and baskets of fruit to the prisoners, and the mayor said that he loved them as though they were his own sons. But the law in France is in higher hands than those of the municipality. It is swift and sure. The prisoners were taken to the capital city, Clermont, to be tried. The sympathies of the judge were on the side of capital, and he paid little attention to the plea of organized labor. "If your theory is true," said the judge, "you have no sort of claim on the boots you have demanded from the President of the Equitable Confidence Society. All this labor you talk of is simply the moving of things back and forth. How can this confer value? The real work is done by the cow; and the herdsmen on the mountains, who are her heirs and assigns, are the only persons who have a natural lien on the boots which are made from her hide when she is dead. This claim the herdsmen have assigned to capital, and to capital, therefore, all the boots belong."

It is hard to fight against monopolies. The men were condemned. The black flag was raised in the Golden Lion. A good deal was said, but nothing further was done, by organized labor toward taking possession of its own.

A new election was at hand, and the mayor's party issued a call to the workingmen to rally to his support.

"All who believe in the grandeur and glory of France, in the ten commandments, in the theory that the sun is the real center of the solar system, and in the Issoire idea of a perpetual octroi for the defense and development of home interests and the elevation of home labor, who would reduce city taxes and prevent the accumulation of money not needed for city uses, by the perpetuation and extension of the octroi; who are opposed to all schemes tending to dethrone this policy and to reduce Issoire's laborers to the level of the underpaid and oppressed workers of Clermont and Jonas—are called to join in the re-election of Mayor de Rougeâtre and of his supporters in the Common Council."

The mayor spoke from the steps of the Hôtel de Ville in defense of the octroi, on the success of which agency he justly based his claim for re-election.

He showed how the octroi had changed Issoire from a dull and peaceful agricultural village with few industries, and those only the ones for which the town possessed special advantages, into a microcosm in which a little of everything was made and sold. Issoire was no longer a town where nothing happened, and in which the procession of grain-wagons, the same yesterday, to-day, and to-morrow, wearied the eye and the ear with their ceaseless monotony. It was a city in which the clashing of interests and the fluctuation of prices made every one anxious for the morrow's sun to rise that he might see what would happen next. He spoke of the promising infant, the industry of boot-making, which had always stood in the fore-front of Issoire's development. He touched lightly on the late labor difficulties, as a mere incident in the city's progress, "a spark struck out from the clashing of great interests as from flint and steel." "Different directions may produce such," said he, unconsciously quoting from an earlier economist, "nay, different velocities in the same direction." Then he spoke of the value of the octroi to the workingman and of the charmed life he leads at Issoire. He repeated all the arguments drawn from the prices of boots and the prices of labor which the schoolmaster had written out for him, and everything went on beautifully till near the close, when the master-workman Jacques rose to ask a question.

"How is it," said he, "if the lot of the workingman is so pleasant in Issoire, that there is not a single workingman from Issoire in one of the factories in this city? How is it that the mills are

full of paupers and 'rats' from Clermont and Jonas? How is it that the census shows that Issoire is actually poorer to-day than she was ten years ago, that her pauper roll is ten times as large, and the only citizens who have grown rich are the city officers and the members of Issoire's iniquitous Equitable Confidence Societies? If the octroi is to benefit the laborers of Issoire, why don't you put it on the outside fellows who swarm in Issoire, and not on the Issoire laborers' food and clothing? It seems to me, sir, that when a city begins to fix things to help one set of men and then another, rather than to consider the common good of all, it is on dangerous ground. Once started on this sort of thing, everybody clamors for his share. Every man too lazy to work, and every man whose business does not pay, seems to think that the rest of the town owe him a living."

Warming up with the subject, he continued:

"Take this millstone business of yours, for example. It is all folly to talk of the wealth in your stone-quarries, if you have to hire their owners to work them. If we can buy millstones in Clermont for less than it costs to cut them in Issoire, it is money in our pockets to leave them in the ground. If any line of business needs to be constantly propped up, and can not live except at the expense of its neighbors, it is no industry at all. It is a beggary. And this octroi of yours has made a beggar or a brigand of every industry in Issoire!"

But the mayor waved his hand and smiled, and said that some men were never satisfied. They would grumble about the golden pavements of the New Jerusalem, if they could not turn them into legal tender. Then he referred to a conspiracy among men suborned by Clermont gold, to flood the streets of Issoire with cheap bread and meat and potatoes and clothing. He asked all who wanted to be slaves to Clermont to rise and be counted. He showed that, of all people on earth, the people of France were the happiest; of all people in France, those of Issoire were most favored; and of those in Issoire, the best of all were the workingmen, the especial guardians of the Issoire idea.

Meanwhile the extension of the octroi to 3,872 articles had greatly increased the wealth of the city, and the city treasurer's strong-box was so full that he had to make a second one, and to hire three trusty Clermont men to watch it day and night, and then three men from Jonas to watch the first three. What should be done with the money to keep it in circulation, for, if it remained locked up, the wheels of industry would soon begin to creak, and creaking is a sign that wheels need oiling?

The mayor had proposed to divide it among the several Equitable Confidence Societies, in order to encourage industry, and thus enable these companies to raise still higher the high wages

of the men from Jonas, who were now the only laborers employed in Issoire. But this was objected to in several quarters, especially by the followers of the workman Jacques, who did not like to trust the Equitable Societies to make such a division.

The schoolmaster wanted it divided among the school-children pro rata in proportion to their raggedness. This was favored by almost every one, because it would benefit the laboring-man and help on the clothing-trade; but the politicians objected to giving money to the poor, because such giving tends simply to enervate. The very fact that a man is poor shows that he is not fitted to take care of money. Some wanted the city wall built up so high that no one could see out of the town, and then to have the top so beset with broken bottles that no one could climb over. A few of the extreme devotees of the Issoire idea wanted the surplus devoted to destroying the roads to Clermont, that all danger from the flood of cheap goods with which that city stood always ready to overwhelm Issoire would be removed forever. One of the Council even wished to use it for the permanent closing of all the city gates, for, as he said, "if we are good citizens we will have nothing to do with abroad."

But the private secretary of the mayor remarked that altogether too much had been said of this matter of surplus revenue. "It is a good deal easier," he remarked, sagely, "to manage a surplus than a deficit." Then the mayor said: "It is much better to have too much money than too little. That is what constitutes prosperity. I wouldn't mind having a little surplus myself." Then the Council laughed, and each one thought of what he could do with his share of the surplus, while they discussed some plans which looked toward an equitable distribution of it in places where it would do the most good.

The workman Jacques, who was now a member of the Council, and who had been selected as the opposition candidate for mayor, rose and said: "This octroi stuff is all bosh. It is a tax to make things higher, and it comes out of our pockets. That is why we are so poor. The mayor says that it is collected from the Clermont merchants. The mayor lies. What does a Clermont merchant care whether we pay him ten francs for a pair of boots outside the city gates, or twenty francs inside, after he has paid ten francs toll? It is all the same to him. He loses nothing either way, except that our ridiculous laws have lost him a good customer for his woolen goods, and we have lost a good customer for our wines and wheat. If I can save ten francs by buying my boots at Clermont, have I not a right to save it, and whose business is it if I do? The octroi is putting into the city treasury every year fifty thousand francs more than the city has any honest use for, and the whole town will go into bankruptcy if this

goes on for three years more. There isn't money enough in the city to keep up this surplus. The money can not get out of the treasury unless some one steals it out and puts it into circulation; and, if I understand you, gentlemen, this is just what you propose to do."

This speech was the sensation of the day. It was spoken with a blunt earnestness such as well-meaning but ignorant men are often found to possess. Its sophistries were not at first apparent, for the very reason that the speaker himself did not know them to be sophistries.

It was printed next morning in the Issoire "Etoile," and it made many converts among those who were unable to expose its errors. The landlord of the Hôtel de la Poste indorsed it, because the patronage of that excellent hostelry had greatly declined since the cessation of the barter with Clermont. Some of the manufacturers favored it, for they were looking for wider outlets for their trade, as the market of Issoire was soon glutted, and the octroi increased the cost of manufacture even more than it raised the price of the finished goods. The politicians said that it might be true enough, but plain talk like that would ruin any man's chances in a popular election. Jacques should have remembered that he was a candidate. The parson, who seldom meddled with politics, declared that the address was timely and patriotic, and that the real friend of the laboring-man was the man who gave him justice instead of patronage. He further said that, in his opinion, the mayor and Council were wrong in their theories of wealth. Their fundamental error was this, that they were trying to make the people of this city grow rich off each other. He even marched in a procession which went through the streets, carrying banners inscribed: "Vive Jacques, the Master-Workman!" "A bas l'Octroi!" "Away with Useless Taxes!"

But the reaction soon came, as it always comes in the politics of France, and it was due to the Clermont papers. They published Jacques's speech in full, with words of great approbation.

In the Clermont "Libéral" were the head-lines: "Long live Mayor Jacques!" "Down with the Demagogues!" "Issoire coming to her Senses!" "The Workingmen repudiate the Octroi!" "Good Prospects for the Clermont Trade!"

It was on the very eve of the election that the Clermont papers were received in Issoire. It was enough. What sophistry had seduced, patriotism reclaimed. The mayor said that, if Jacques was elected, the octroi would be removed at once, every man in Issoire would be ruined, and the city, bound hand and foot, would be delivered over to Clermont. Ten wagon-loads of goods would be sent in the place of one, and not all the money in the whole city would suffice to pay for them. Then he read from the Cler-

mont "Libéral" an editorial in which Jacques was compared to Arnold Winkelried and to Charles Martel and to St. Austremoine, the first hero of Issoire. The effect was tremendous. Every word from Clermont in praise of Jacques was, as the mayor said, "one more nail in his coffin."

The election-day came at last—as such days always come. It was a bright Sabbath afternoon in early August, for in France elections are always held on Sunday afternoons. The birds sang in the poplar-trees, the wheat-fields looked yellow through the city gates, the Café du Lion d'Or was covered with flags and with red ribbons in honor of Jacques, while the Café de la Comédie was similarly draped in blue in honor of his rival. The people were out in their best clothes and Issoire-made boots, and the candidates were among them—all smiles and attention, though I thought that a slightly misanthropic expression lurked about the big workman's mouth.

The bands played, and rival processions moved about in the street. The longest of these carried banners inscribed "Vive l'Octroi!" "A bas Clermont!" "Le Surplus toujours!" "De Rougeâtre forever!" Everybody seemed falling into line, and so I followed, keeping step with the music.

All at once I heard a fearful, blood-curdling scream. The procession swiftly dissolved, the music ceased, the banners vanished. I rubbed my eyes and looked about me. I was sitting on an inverted nail-keg at the Clermont gate just outside the city of Issoire. The old gendarme who guarded the gate was slowly drawing a dripping sword out of a large bundle of oats, in which he had thrust it while performing his duty as inspector. Within the oats was great excitement. The contraband hog concealed inside was lustily kicking and filling the air with his frantic screams.

And thus I knew that the city had been saved, for the octroi was still going on.

And it is going on yet.

## THE HOME OF THE GREAT AUK.

By FREDERIC A. LUCAS.

THE fate of the great auk in its New World home is well known; how it was slaughtered for its flesh, slaughtered for its feathers, slaughtered for the mere wanton love of destruction, until after nearly three centuries of persecution the last great auk disappeared from the face of the earth. All this has been described, so that the bird and its history are fairly well known.

Less, however, has been written of its chosen breeding-grounds, as these were usually outlying islands of difficult access, but little frequented now by those who have either time or desire to devote

to the subject. It was the good fortune of the writer, during the summer of 1887, to visit the favorite resort of the great auk.

This spot, lying thirty-two miles to the north and east of Cape Freels, Newfoundland, is Funk Island, whose granite sides and outlying reefs form a constant menace to the few vessels navigating the adjacent waters. Separated from it by intervals of six hundred and twelve hundred yards are two small, low islets, washed completely over in storms, the three constituting the group known as the Funks, although popularly the plural is often used when speaking of the larger island only. The locality is of considerable interest to the St. John's sealers, from the fact that the vast herds of seals that drift down from the north in the early spring are usually encountered and slain somewhere in this vicinity.

But to the ornithologist the chief interest of Funk Island will ever lie in its having been the headquarters of the great auk, the number of birds frequenting other localities being insignificant when compared with the feathered legions who dwelt on the granite cliffs of this lonely spot. Should this be doubted, it must be remembered that the work of extermination required more than two centuries of slaughter, while to-day the soil is whitened by the fragments of myriads of egg-shells.

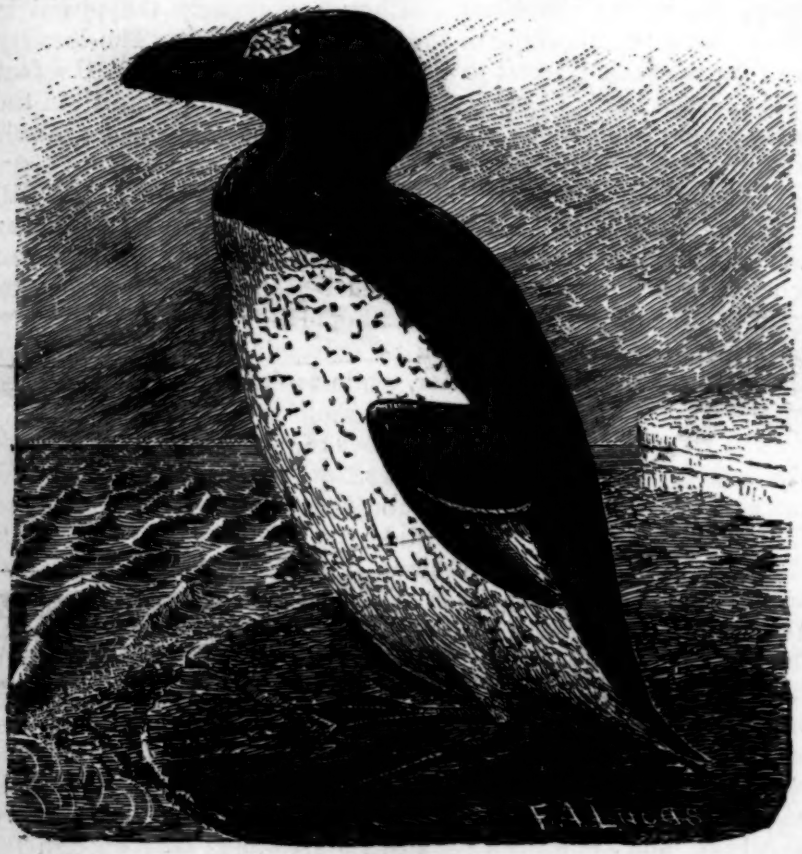
The writer had long been desirous of procuring some bones of the great auk for the United States National Museum; and when in the spring of 1887 it was found that the work of the United States Fish Commission would take the schooner Grampus along the eastern coast of Newfoundland, it was decided that she should visit Funk Island, and he was detailed to accompany her. Daybreak on the morning of July 22d found the vessel about ten miles distant from the Funks, toward which she was slowly progressing before a light but fortunately favorable wind. But for the distance intervening between the schooner and her destination the weather would have been pronounced simply perfect, for fine weather is by no means common in this latitude, and yet it is essential for landing on this rocky outpost.* The morning wore slowly on, and not until noon was the Grampus near enough for a boat to be lowered and a start made for the shore.

The plan agreed upon was to take ashore in the first boat all things needful for a stay of several days, so that, a landing once effected, we would not be forced to quit the island by threatening weather, but could remain and prosecute our work, while the schooner sought safer quarters than near the breakers, which in rough weather are found in the vicinity of Funk Island. It was, therefore, with a well-loaded dory that we left the Grampus a mile

* A short time after our departure a French collector spent some time at the Funks, vainly waiting for an opportunity to land, and finally departed unsuccessful.

from the northeastern point and pulled briskly in to look for a landing-place.

Viewing the island from a distance, it had appeared possible, with the light breeze then blowing, to beach a boat on the southerly slope; but, on closer approach, the seemingly narrow line of foam fringing the shelving rock had become transformed into the wash of a heavy swell upon a steep and slippery shore of granite, on which landing was quite out of the question.



THE GREAT AUK.

Indefinite as was most of the information gathered in regard to the Funks during a stop at St. John's, all accounts agreed in locating the best landing on the northern side, not far from Escape Point, the eastern extremity. To this spot, known as the "Bench," we were also directed by the crew of a fishing-boat near by; and, passing the point on which the smooth swells broke into ragged patches of foam, a few minutes later found our boat lying at the foot of a low cliff, whose weathered side rose almost perpendicularly from the water. Right in the face of this cliff is a nar-

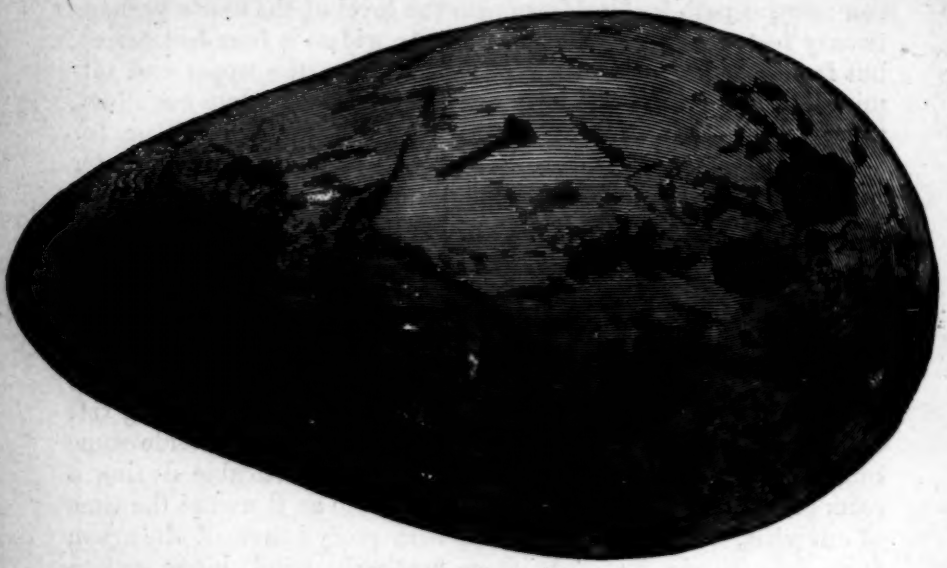
row natural path leading from near the level of the sea to perhaps twenty feet above it. The path at its widest is four feet across, but from this it tapers either way to nothing, the upper end terminating in a fissure just large enough to accommodate one's foot, the rough, weathered granite forming a very good substitute for a hand-rail. Indeed, Nature has probably never devised a better rock for climbing purposes than the coarse-grained, feldspathic granite composing Funk Island, which weathers into crannies and projections whose rough surfaces offer secure support for hand and foot.

Below the "Bench" the cliff descends almost vertically to a depth of one hundred and twenty feet beneath the sea, this combination of deep water and perpendicular rock offering no obstacle to chafe the sea into breaking, so that, but for the never-ceasing rise and fall of the swell, one almost seems to be lying beside some huge pier. This landing, however, is only practicable during a calm or with a southerly wind; and, smooth as it was at the time of our visit, the boat rose and fell with every heave of the ocean from four to six feet. With a northerly wind, boats seek a more precarious landing at the southwestern extremity of the island.

Once on the "Bench," to which we hastened to transfer ourselves and all our baggage, it is an easy matter to reach the summit of the island, either by scrambling directly up the rock or by an easier but longer zigzag path.

The result of a careful study of the island during the forenoon had been a unanimous decision that the precipitous character of a large portion of the shore hardly bore out Prof. Milne's simile of its likeness to an upturned saucer. Viewed from the eastern bluffs, it looks not only steep but larger and higher than most accounts would lead one to suppose. Its greatest length seems over half a mile, and its greatest width something over a quarter; so that Cartier, who came here in 1532 and 1534, can not be far out of the way when he says "it containeth about a league in circuit." While it may be a little presumptuous to question the height of forty-six feet given on the chart, nevertheless sixty feet would apparently be much nearer the mark.

Two faults, deepened by time into shallow valleys, divide the island into three ridges running almost east and west. The northern and central of these are bare rock, for the most part smoothed and rounded by rain and ice, but here and there weathered into curious, overlapping ledges. Here, where there is no soil whatever, the smell of guano arising from the droppings of the murres and puffins is quite noticeable, but elsewhere there is but little odor, and that due to the puffins. Rain has washed the soluble matter from the ancient soil of the island, while the heaps of auk



EGG OF THE GREAT AUK.

The great auk's egg, of which a natural-size representation is given in the accompanying figure, was recently sold at auction in England for £225; this is the highest price ever given for a single egg at any auction in England. This one was bought by its late owner, in 1851, for £18. Of the sixty-seven recorded specimens of this egg, forty-four are in Great Britain. Some two hundred and fifty years ago, vessels fishing on the Banks of Newfoundland made great use of these birds for provisions. They were plentiful in that vicinity, and when found on land could be captured wholesale by simply placing a plank from the shore to a boat, up which the auks could be driven. Having no power of flight, the species gradually disappeared from America, and from Europe not long after, the last two specimens of which there is trustworthy evidence having been killed in Iceland in 1844.

bodies long ago crumbled away, yielding up the odor they may once have possessed.

Between the central and southern rise are numerous shallow pools of rain-water, rendered brackish by the driving spray, but still fresh enough to be drunk in case of emergency. Just such an emergency befell a party of eggers some twenty years ago when their schooner was forced away by stress of weather, leaving the men who had landed to subsist for eleven days on a varied diet of eggs, birds, and brackish water.

On the western portion of the southernmost swell of rock lie the former breeding-grounds of the great auk, now mapped out in rich green by the rank vegetation covering this, the soil-clad part of the island. This section alone was accessible to the flightless garefowl, and here in days gone by the great auk scrambled through the breakers and over the slippery rocks, which north and south slope into the sea, to reach its nesting-place. Here, to-day, its bones lie buried in the shallow soil, every weathered slab of granite marking the resting-place of some ill-fated bird. The industrious puffins, whose labors have everywhere honey-combed the ground, play the part of resurrectionists, and the entrance to

each burrow is ornamented by a little heap of slowly whitening bones.

To our party these little osteological collections were a goodly sight, settling at once the question of finding remains of the great auk, and indicating by their presence the existence of other bones yet to be brought to light. Fortunately, the anatomy of the great auk is peculiar, so that there could be no doubt but what the bones here and there strewed on the surface were the bones we had come so far to seek.

There is not the slightest possibility of any bone of the razor-bill or murre being mistaken for that of their huge relative the great auk; and, in fact, of all the bones exhumed, there was little more than a handful belonging to any bird save this giant among auks.

Crowning the summit of the island are the ruins of a stone hut, years ago the winter quarters of a sealing-party, placed here to await the coming of the seals on the drifting ice of early spring. The experiment resulted fatally, for all save the cook were drowned while hunting, and he, the sole survivor, was almost insane when rescued.

Not far from here, an old chest, peeping from beneath a pile of stone, marks the grave of another sealer, a young man from Green Bay, who, carried out into the fog by drifting ice, perished miserably near this forlorn spot.

Near by are the almost obliterated walls of two small structures, overgrown with weeds, which in default of any tradition may be surmised to be the dwellings of the old-time destroyers of the auk.

The stones of which these huts were built, as well as those forming the inclosures in which the auks were confined to await their slaughter, were quarried by Nature from the granite rock of the island. Time and frost split this into blocks of varying size and thickness, and, just where the great auks were most abundant, just there the slabs of stone lay thickest, as if Nature wished to aid man in his work of destruction.

There are no bowlders of foreign origin on this part of the island, nor did we see any along the sloping northwestern shore, although Prof. Milne found some there at the time of his visit in 1874. Many of the inclosures just alluded to ("compounds" they were termed) have disappeared, but others are still distinctly outlined, although most of the stone slabs composing them now lie prostrate. The two best-preserved pens, located some little distance from the southwestern landing, are about twelve feet square, and not one block of stone is missing.

Close by these compounds we upturned the sod over a circle ten feet in diameter, beneath which the soil was composed of

charcoal and auk-bones, the charred condition of the latter testifying to the truth of the accounts that the fat bodies of the slain birds were used as fuel to heat water for scalding their companions—a near approach to seething the kid in its mother's milk. Other cooking places, where the birds were scalded and plucked, lie scattered along the crest of the southern slope, although it is only by much digging that their existence is brought to light. An excavation made near the best-preserved pens revealed the fact that here was probably one of the last places where the great auk was taken. Scarcely two inches of turf covered the shallow soil in which lay imbedded a few fresh-looking bones of the great auk, mixed with others belonging to its relative, the murre. Evidently, the great auk was even then on the wane; its numbers were no longer sufficient to supply the demands of the feather-hunters, who, like their successors, promptly supplied the deficiency with the next bird at hand.

The great auk, by the way, is not the only bird exterminated on Funk Island, for the gannet lives only in the name, Gannet Head, although it was abundant in the time of Cartier, and, according to report, still lingered thirty years ago.

Thanks to the efforts of the eggers, the numbers of all birds breeding here have greatly lessened during the last twenty years, and only the puffin, whose security lies in his burrow, seems able to hold his own.

The soil of Funk Island is in two distinct layers, the lower of which, mostly formed during the occupancy of the great auk, is from three inches to a foot in thickness. Next the bed-rock lie a few angular pebbles, of various sizes, mixed with and covered by a deposit containing innumerable fragments of egg-shells, the whole having a yellowish-gray appearance. Even were there but few bones present, the character of this stratum is in itself sufficient to indicate the immense number of auks formerly breeding here, as well as the length of time during which they made Funk Island their resort. Also, were there no testimony to the contrary, the shallowness of the soil would show the inaccuracy of those writers who state that the great auk nested in a burrow. The upper stratum of soil has been formed since the extermination of the auks, principally by the growth and decay of the vegetation, nourished by their decomposing bodies. This fine, dark-colored, superficial layer, covered with thick, loose turf, formed by the matted roots of plants, also varies in thickness from three or four inches to a foot. In it are found the great majority of bones, the patches of charcoal indicating the location of the cooking-places, and, very rarely, linings of eggs in a more or less dilapidated condition.

By far the best-preserved remains occur in the older soil, where

they are less exposed to the action of the weather, so that, contrary to what might have been expected, the more recently killed birds are the poorest for anatomical purposes.

These Alcine remains, if one may judge from the brief accounts of the few visits made to Funk Island, are rapidly deteriorating. Thus, in 1863, a party of guano-seekers came upon four nearly entire, dried-up bodies; while, in 1874, Prof. Milne secured in half an hour bones representing fifty individuals from which four more or less complete skeletons were reconstructed.

In 1887 our party passed the better part of two busy days in the work of excavating bones of the great auk; and, although the material secured represents hundreds of individuals, it may not make more than a dozen skeletons, and these not all absolutely perfect.

So difficult is it to procure certain bones in a good state of preservation, that the collection of the United States National Museum contains but a single perfect sternum, and one nearly perfect pelvis. Twenty-five years have elapsed since the "mummies" were secured; and while it is quite possible that others may yet be exhumed, it will be either by rare good fortune or an unlimited amount of digging, for, in the hope of coming upon a "mummy," many holes were sunk quite to the bed-rock, but without success. Curiously enough, these bones rarely bear any mark to indicate that the birds were killed by stick or knife, a fact which caused Prof. Milne to remark that this "leads to the supposition that the birds may have died peacefully." Birds that die peacefully, however, seem to have a habit of making away with their skeletons, and on Funk Island there are few bones to be found of any bird save the great auk.*

Even in the immense guano deposits of the Chincha Islands, where the perfect dryness of the soil is unusually favorable to the preservation of inhumed specimens, bird remains are of rare occurrence.

Some of the crania, too, found on Funk Island, bear fractures that must have been caused by a heavy blow, and one specimen met with had evidently come to its death from the stroke of a knife. Prof. Milne's second surmise, that the bones "were the remains of some great slaughter, when the birds had been killed, parboiled, and despoiled only of their feathers; after which they were thrown in a heap," is undoubtedly correct. Not only is the conjecture borne out by current tradition, and by the intermingled condition of the skeletons, but by the distorted appearance of many bones, which, like the ribs, pelvis, and wish-bone, would be most easily affected by pressure.

* Since this was written I have had time to examine the material more carefully, and find that a large number of the crania are fractured.

The mixed state of the bones, for which the busy puffins are to some extent responsible, renders it absolutely impossible to secure the skeleton of any given individual, and makes it necessary to procure a large number of bones in order that there should be the least chance of reconstructing an entire specimen. A skeleton recently mounted for the exhibition series of the United States National Museum is absolutely perfect, while the number of bones secured by our party on the Grampus probably exceeds that of all other collections combined. Some of these are naturally in a poor state of preservation, but others are quite perfect, and, save for their discoloration, in as good condition as if buried only for two or three years.

It would scarcely be just to close this article without giving all due credit to Captain J. W. Collins, whose cordial support of the proposed expedition finally determined the sending of the Grampus to Funk Island, and made the trip so decidedly a success. The thanks of the party are also tendered to the Rev. M. Harvey, of St. John's, for the advice and information so cheerfully given them.

## THE ETHICS OF KANT.

By HERBERT SPENCER.

IF, before Kant uttered that often-quoted saying in which, with the stars of Heaven he coupled the conscience of Man, as being the two things that excited his awe, he had known more of Man than he did, he would probably have expressed himself somewhat otherwise. Not, indeed, that the conscience of Man is not wonderful enough, whatever be its supposed genesis; but the wonderfulness of it is of a different kind according as we assume it to have been supernaturally given or infer that it has been naturally evolved. The knowledge of Man in that large sense which Anthropology expresses, had made, in Kant's day, but small advances. The books of travel were relatively few, and the facts which they contained concerning the human mind as existing in different races, had not been gathered together and generalized. In our days, the conscience of Man as inductively known has none of that universality of presence and unity of nature which Kant's saying tacitly assumes. Sir John Lubbock writes:

"In fact, I believe that the lower races of men may be said to be deficient in the idea of right. . . . That there should be any races of men so deficient in moral feeling, was altogether opposed to the preconceived ideas with which I commenced the study of savage life, and I have arrived at the conviction by slow degrees, and even with reluctance."—*Origin of Civilization*, 1882, pp. 404, 405.

But now let us look at the evidence from which this impression

is derived, as we find it in the testimonies of travelers and missionaries.

Praising his deceased son, Tui Thakau, a Fijian Chief, concluded "by speaking of his daring spirit and consummate cruelty, as he could kill his own wives if they offended him, and eat them afterwards."—*Western Pacific.* J. E. Erskine, p. 248.

"Shedding of blood is to him no crime, but a glory . . . to be somehow an acknowledged murderer is the object of the Fijian's restless ambition."—*Fiji and the Fijians.* Rev. T. Williams, i, p. 112.

"It is a melancholy fact that when they [the Zulu boys] have arrived at a very early age, should their mothers attempt to chastise them, such is the law, that these lads are at the moment allowed to kill their mothers."—*Travels and Adventures in Southern Africa.* G. Thompson, ii, p. 418.

"Murther, adultery, thievery, and all other such like crimes, are here [Gold Coast] accounted no sins."—*Description of the Coast of Guinea.* W. Bosman, p. 130.

"The accusing conscience is unknown to him [the East African]. His only fear after committing a treacherous murder is that of being haunted by the angry ghost of the dead."—*Lake Regions of Central Africa.* R. F. Burton, ii, p. 336.

"I never could make them [East Africans] understand the existence of good principle."—*The Albert N'yanza.* S. W. Baker, i, p. 241.

"The Damaras kill useless and worn-out people: even sons smother their sick fathers."—*Narrative of an Explorer in Tropical South Africa.* F. Galton, p. 112.

The Damaras "seem to have no perceptible notion of right and wrong."—*Ibid.*, p. 72.

Against these we may set some converse facts. At the other extreme we have a few Eastern tribes—pagans they are called—who practice the virtues which Western nations—Christians they are called—do but teach. While Europeans thirst for blood revenge in much the same way as the lowest savages, there are some simple peoples of the Indian Hills, as the Lepchas, who "are singularly forgiving of injuries;"* and Campbell exemplifies "the effect of a very strong sense of duty† on one of these savages." That character which the creed of Christendom is supposed to foster, is exhibited in high degree by the Arafuras (Papuans) who live in "peace and brotherly love with one another"‡ to such extent that government is but nominal. And concerning various of the Indian Hill-tribes, as the Santáls, Sowrahs, Marias, Lepchas, Bodo and Dhimáls, different observers testify of them severally that "they were the most truthful set of men I ever met,"* "crime and criminal officers are almost unknown,"‖ "a pleasing feature in their character is their complete truthfulness,"^ "they bear a

* Campbell in "Journal of the Ethnological Society," N. S., vol. i, 1869, p. 150.

† Ibid., p. 154.

‡ Dr. H. Kolff. "Voyages of the Dutch brig 'Dourga.'" Earl's translation, pp. 161, 163.

* W. W. Hunter. "Annals of Rural Bengal," p. 248.

‖ Ibid., p. 217.

^ Dr. J. Shortt. "Hillranges of Southern India," pt. iii, p. 38.

singular character for truthfulness and honesty,"* they are "wonderfully honest,"† "honest and truthful in deed and word."‡ Irrespective of race, we find these traits in men who are, and have long been, absolutely peaceful (the uniform antecedent); be they the Jakuns of the South Malayan Peninsula, who "are never known to steal anything, not even the most insignificant trifle,"* or be it in the Hos of the Himalaya, among whom "a reflection on a man's honesty or veracity may be sufficient to send him to self-destruction."‖ So that in respect of conscience these uncivilized people are superior to average Europeans, as average Europeans are superior to the brutal savages previously described.

Had Kant had these and kindred facts before him, his conception of the human mind, and consequently his ethical conception, would scarcely have been what they were. Believing, as he did, that one object of his awe—the stellar Universe—has been evolved, he might by evidence like the foregoing have been led to suspect that the other object of his awe—the human conscience—has been evolved; and has consequently a real nature unlike its apparent nature.

For the disciples of Kant living in our day, there can be made no such defense as that which may be made for their master. On all sides of them lie classes of facts of various kinds, which might suffice to make them hesitate, if nothing more. Here are a few such classes of facts.

Though, unlike the uncultured who suppose everything to be what it appears, chemists had, for many generations, known that multitudinous substances which seem simple are really compound, and often highly compound; yet, until the time of Sir Humphry Davy, even they had believed that certain substances which, besides seeming simple resisted all their powers of decomposition, were to be classed among the elements. Davy, however, by subjecting the alkalies to a force not before applied, proved that they are oxides of metals; and, suspecting the like to be the case with the earths, similarly proved the composite nature of these also. Not only the common sense of the uncultured but the common sense of the cultured was shown to be wrong. Wider knowledge has, as usual, led to greater modesty; and since Davy's day chemists have felt less certain that the so-called elements are elementary. Contrariwise, increasing evidence of sundry kinds leads

* Glasfind in "Selections from the Records of Government of India" (Foreign Department), No. xxxix, p. 41.

† Campbell in "Journal of the Ethnological Society," N. S., vol. i, 1869, p. 150.

‡ B. H. Hodgson in "Journal of the Asiatic Society of Bengal," xviii, p. 745.

* Rev. P. Favre in "Journal of the Indian Archipelago," ii, p. 266.

‖ Col. E. T. Dalton. "Descriptive Ethnology of Bengal," p. 206.

them to suspect more and more strongly that they are all compound.

Alike to the laborer who digs it out and to the carpenter who uses it in his workshop, a piece of chalk appears a thing than which nothing can be simpler; and ninety-nine people out of a hundred would agree with them. Yet a piece of chalk is highly complex. A microscope shows it to consist of myriads of shells of *Foraminifera;* shows further that it contains more kinds than one; and shows further still that each minute shell, whole or broken, is formed of many chambers, every one of which once contained a living unit. Thus by ordinary inspection, however close, the true nature of chalk can not be known; and to one who has absolute confidence in his eyes the assertion of its true nature appears absurd.

Take again a living body of a seemingly uncomplicated kind—say a potato. Cut it through and observe how structureless its substance. But though unaided vision gives this verdict, aided vision gives a widely different one. Aided vision discovers, in the first place, that the mass is everywhere permeated by vessels of complex formation. Further, that it is made up of innumerable units called cells, each of which has walls composed of several layers. Further still, that each cell contains a number of starch-grains. And yet still further, that each of these grains is formed of layer within layer, like the coats of an onion. So that where there seems perfect simplicity there is really complexity within complexity.

From these examples which the objective world furnishes, let us turn to some examples furnished by the subjective world—some of our states of consciousness. Up to modern times any one who, looking out on the snow, was told that the impression of whiteness it gave him was composed of impressions such as those given by the rainbow, would have regarded his informant as a lunatic; as would even now the great mass of mankind. But since Newton's day, it has become well known to a relatively small number that this is literal fact. Not only may white light be resolved by a prism into a number of brilliant colors, but by an appropriate arrangement these colors can be re-combined into white light. Those who habitually suppose that things are what they seem, are wrong here as in multitudinous other cases.

Another example is supplied by the sensation of sound. A solitary note struck on the piano, or a blast from a horn, yields through the ear a feeling which appears homogeneous; and the uninstructed are incredulous if told that it is an intricate combination of noises. In the first place, that which constitutes the more voluminous part of the tone is accompanied by a number of over-tones, producing what is known as its *timbre:* instead of one

note, there are half a dozen notes, of which the chief has its character specialized by the others. In the second place, each of these notes, consisting objectively of a rapid series of aërial waves, produces subjectively a rapid series of impressions on the auditory nerve. Either by Savart's machine or by the siren, it is proved to demonstration that every musical sound is the product of successive units of sound, each in itself unmusical, which, as they succeed one another with increasing rapidity, produce a tone which progressively rises in pitch. Here again, then, under an apparent simplicity there is a double complexity.

Most of these examples of the illusiveness of unaided perception, whether exercised upon objective or subjective existences, were unknown to Kant. Had they been known to him they might have suggested other views concerning certain of our states of consciousness, and might have given a different character to his philosophy. Let us observe what would possibly have been the changes in two of his cardinal conceptions—metaphysical and ethical.

Our consciousness of Time and Space appeared to him, as they appear to every one, perfectly simple; and the apparent simplicity he accepted as actual simplicity. Had he suspected that, just as the seemingly homogeneous and undecomposable consciousness of Sound really consists of multitudinous units of consciousness, so might the apparently homogeneous and undecomposable consciousness of Space, he would possibly have been led to inquire whether the consciousness of Space is not wholly composed of infinitely numerous relations of position, such as those which every portion of it presents. And finding that every portion of Space, immense or minute, can not be either known or conceived save in some relative position to the conscious subject, and that, besides involving the relations of distance and direction, it invariably contains within itself relations of right and left, top and bottom, nearer and further; he might perhaps have concluded that our consciousness of that matrix of phenomena we call Space, has been built up in the course of Evolution by accumulated experiences registered in the nervous system. And had he concluded this, he would not have committed himself to the many absurdities which his doctrine involves.*

Similarly, if, instead of assuming that conscience is simple because it seems simple to careless introspection, he had entertained the hypothesis that it is perhaps complex—a consolidated product of multitudinous experiences received mainly by ancestors and added to by self—he might have arrived at a consistent system of Ethics. That the habitual association of pains with certain

* See "Principles of Psychology," § 399.

things and acts, generation after generation, may produce organic repugnance to such things and acts,* might, had it been known to him, have made him suspect that conscience is a product of Evolution. And in that case his conception of it would not have been incongruous with the facts above named, showing that there are widely different degrees of conscience in different races.

In brief, as already implied, had Kant, instead of his incongruous beliefs that the celestial bodies have had an evolutionary origin, but that the minds of living beings on them, or at least on one of them, have had a non-evolutionary origin, entertained the belief that both have arisen by Evolution, he would have been saved from the impossibilities of his Metaphysics, and the untenabilities of his Ethics. To the consideration of these last, let us now pass.

Before doing this, however, something must be said concerning abnormal reasoning as compared with normal reasoning.

Knowledge which is of the highest order in respect of certainty, and which we call exact science, is distinguished from other knowledge by its definitely quantitative previsions.† It sets out with data, and proceeds by steps, which, taken together, enable it to say under what specified conditions a specified relation of phenomena will be found; and to say in what place, or at what time, or in what quantity, or all of them, a certain effect will be witnessed. Given the factors of any arithmetical operation, and there is absolute certainty in the result reached, supposing there are no stumblings: stumblings which always admit of detection and disproof by the method which we shall presently find is pursued. Base and angles having been accurately measured, geometry yields with certainty the distance or the height of the object of which the position is sought. The ratio of the arms of a lever having been stated, mechanics tells us what weight at one end will balance an assigned weight at the other. And by the aid of these three exact sciences, the Calculus, Geometry, and Mechanics, Astronomy can predict to the minute, for each separate place on the Earth, when an eclipse will begin and end, and how near it will approach to totality. Knowledge of this order has infinite justifications in the successful guidance of infinitely numerous human actions. The accounts of every trader, the operations of every workshop, the navigation of every vessel, depend for their trustworthiness on these sciences. The method they pursue, therefore, verified in cases which pass all human power to enumerate, is a method not to be transcended in certainty.

What is this method? Whichever of these sciences we exam-

* See "Principles of Psychology," § 189 (note) and § 520.

† See Essay on "Genesis of Science."

ine, we find the course uniformly pursued to be that of setting out with propositions of which the negations are inconceivable, and advancing by successive dependent propositions, each of which has the like character—that its negation is inconceivable. In a developed consciousness (and of course I exclude minds of which the faculties are unformed) it is impossible to represent things that are equal to the same thing as being themselves unequal; and in a developed consciousness, action and re-action can not be thought of as other than equal. In like manner, every *because*, and every *therefore*, used in a mathematical argument, connotes a proposition of which the terms are absolutely coherent in the mode alleged: the proof being that an attempt to bring together in consciousness the terms of the opposite proposition is futile. And this method of testing, alike the fundamental propositions and all members of the fabric of propositions raised upon them, is consistently pursued in verifying the conclusion. Inference and observation are compared; and when they agree, it is inconceivable that the inference is other than true.

In contrast to the method which I have just described, distinguishable as the legitimate *a priori* method, there is one which may be called—I was about to say, the illegitimate *a priori* method; but the word is not strong enough: it must be called the inverted *a priori* method. Instead of setting out with a proposition of which the negation is inconceivable, it sets out with a proposition of which the affirmation is inconceivable, and therefrom proceeds to draw conclusions. It is not consistent, however: it does not continue to do that which it does at first. Having posited an inconceivable proposition to begin with, it does not frame its argument out of a series of inconceivable propositions. All steps after the first are of the kind ordinarily accepted as valid. The successive *therefores* and *becauses* have the usual connotations. The peculiarity lies in this, that in every proposition save the first, the reader is expected to admit the logical necessity of an inference drawn, for the reason that the opposite is not thinkable; but he is not supposed to expect a like conformity to logical necessity in the primary proposition. The dictum of a logical consciousness which must be recognized as valid in every subsequent step, must be ignored in the first step. We pass now to an illustration of this method which here concerns us.

The first sentence in Kant's first chapter runs thus: "Nothing can possibly be conceived in the world, or even out of it, which can be called good without qualification, except a Good Will." And then on the next page we come upon the following definition:

"A good will is good not because of what it performs or effects, nor by its aptness for the attainment of some proposed end, but simply by virtue of the volition, that is, it is good in itself, and considered by itself is to be esteemed much higher than all that can be brought about by it in favor of any inclination, nay even of the sum total of all inclinations."

Most fallacies result from the habit of using words without fully rendering them into thoughts—passing them by with recognitions of their meanings as ordinarily used, without stopping to consider whether these meanings admit of being given to them in the cases named. Let us not rest satisfied with thinking vaguely of what is understood by "a Good Will," but let us interpret the words definitely. Will implies the consciousness of some end to be achieved. Exclude from it every idea of purpose, and the conception of Will disappears. An end of some kind being necessarily implied by the conception of Will, the quality of the Will is determined by the quality of the end contemplated. Will itself, considered apart from any distinguishing epithet, is not cognizable by Morality at all. It becomes cognizable by Morality only when it gains its character as good or bad by virtue of its contemplated end as good or bad. If any one doubts this, let him try whether he can think of a good will which contemplates a bad end. The whole question, therefore, centers in the meaning of the word good. Let us look at the meanings habitually given to it.

We speak of good meat, good bread, good wine; by which phrases we mean either things that are palatable, and so give pleasure, or things that are wholesome, and by conducing to health conduce to pleasure. A good fire, good clothing, a good house, we so name because they minister either to comfort, which means pleasure, or gratify the æsthetic sentiment, which also means pleasure. So it is with things which more indirectly further welfare, as good tools or good roads. When we speak of a good workman, a good teacher, a good doctor, it is the same: efficiency in aiding others' well-being is what we indirectly mean. Yet again, good government, good institutions, good laws, connote benefits yielded to the society in which they exist: benefits being equivalent to certain kinds of happiness, positive or negative. But Kant tells us that a good will is one that is good in and for itself without reference to ends. We are not to think of it as prompting acts which will profit the man himself, either by conducing to his health, advancing his culture, or improving his inclinations; for all these are in the long run conducive to happiness, and are urged only for the reason that they do this. We are not to think of a will as good because, by fulfillment of it, friends are saved from sufferings or have their gratifications increased; for this would involve calling it good because of bene-

ficial ends in view. Nor must conduciveness to social ameliorations, present or future, be taken into account when we attempt to conceive a good will. In short we are to frame our idea of a good will without any material out of which to frame the idea of good: good is to be used in thought as an eviscerated term.

Here, then, we have illustrated what I have called above the inverted *a priori* method of philosophizing: the setting out with an inconceivable proposition. The Kantian Metaphysics starts by asserting that Space is "nothing but" a form of intuition—pertains wholly to the subject and not at all to the object. This is a verbally intelligible proposition but one of which the terms can not be put together in consciousness; for neither Kant, nor any one else, has ever succeeded in bringing into unity of representation the thought of Space and the thought of Self, as being the one an attribute of the other. And here we see that, just in the same way, the Kantian Ethics begins by positing something which seems to have a meaning but which has really no meaning —something which, under the conditions imposed, can not be rendered into thought at all. For neither he, nor any one else, ever has or ever can, frame a consciousness of a good will when from the word good are expelled all thoughts of those ends which we distinguish by the word good.

Evidently Kant himself sees that his assumption invites attack, for he proceeds to defend it. He says:

"There is, however, something so strange in this idea of the absolute value of the mere will, in which no account is taken of its utility, that notwithstanding the thorough assent of even common reason to the idea, [!] yet a suspicion must arise that it may perhaps really be the product of high-flown fancy, &c." (p. 18).

And then to prepare for a justification, he goes on to say:

"In the physical constitution of an organized being we assume it as a fundamental principle that no organ for any purpose will be found in it but what is also the fittest and best adapted for that purpose" (pp. 13–14).

Now, even had this assumption been valid, the argument based upon it, far-fetched as it is, might be considered of very inadequate strength to warrant the supposition that there can be a will conceived as good without any reference to good ends. But, unfortunately for Kant, the assumption is utterly invalid. In his day, it probably passed without question; but in our day, few if any biologists would admit it. On the special-creation hypothesis some defense of the proposition might be attempted, but the evolution hypothesis tacitly negatives it entirely. Let us begin with some minor facts which militate against Kant's supposition. Take first rudimentary organs. These are numerous throughout the animal kingdom. While representing organs which were of use

in ancestral types, they are of no use in the types possessing them; and as being rudimentary they are of necessity imperfect. Moreover besides being injurious as taxing nutrition to no purpose, they are almost certainly in some cases injurious by being in the way. Then, beyond the argument from rudimentary organs, there is the argument from make-shift organs, which form a large class. We have a conspicuous case in the swimming organ of the seal, formed by the apposition of the two hind limbs —an organ manifestly inferior to one specially shaped for its function, and one which during early stages of the changes which have produced it must have been inefficient. But the untruth of the assumption is best shown by comparing a given organ in a low type of creature with the same organ in a high type. The alimentary canal, for example, in very inferior creatures is a simple tube, substantially alike from end to end, and having throughout all its parts the same function. But in a superior creature this tube is differentiated into œsophagus, stomach (or stomachs), small and large intestines with their various appended glands pouring in secretions. Now if this last form of alimentary canal is to be regarded as a perfect organ, or something like it, what shall we say of the original form; and what shall we say of all those forms lying between the two? The vascular system, again, furnishes a clear instance. The primitive heart is nothing but a dilatation of the great blood-vessel—a pulsatile sac. But a mammal has a four-chambered heart with valves, by the aid of which the blood is propelled through the lungs for aëration, and throughout the system at large for general purposes. If this four-chambered heart is a perfect organ, what is the primitive heart, and what are the hearts possessed by all the multitudinous creatures below the higher *vertebrata?* Manifestly the process of evolution implies a continual replacing of creatures having inferior organs, by creatures having superior organs; leaving such of the inferior as can survive to occupy inferior spheres of life. This is not only so throughout the whole animal creation up to Man himself, but it is so within the limits of the human race. Both the brains and the lower limbs of various inferior races are ineffective organs, compared with those of superior races. Nay, even in the highest type of Man we have obvious imperfections. The structure of the groin is imperfect: the frequent ruptures which result from it would have been prevented by closure of the inguinal rings during fœtal life after they had performed their office. That all-important organ the vertebral column, too, is as yet but incompletely adapted to the upright posture. Only while the vigor is considerable can there be maintained, without appreciable effort, those muscular contractions which produce the sigmoid flexure, and bring the lumbar portion into such a position that

the "line of direction" falls within it. In young children, in boys and girls who are admonished to "sit up," in weakly people, and in the old, the spine lapses into that convex form characteristic of lower *Primates*. It is the same with the balancing of the head. Only by a muscular strain to which habit makes us insensible, as it does to the exposure of the face to cold, is the head maintained in position: immediately certain cervical muscles are relaxed, the head falls forward; and where there is great debility the chin rests permanently on the chest.

So far, indeed, is the assumption of Kant from being true, that the very reverse is probably true. After contemplating the countless examples of imperfections exhibited in low types of creatures, and decreasing with the ascent to high types, but still exemplified in the highest, any one who concludes, as he may reasonably do, that Evolution has not yet reached its limit, may infer that most likely no such thing as a perfect organ exists. Thus the basis of the argument by which Kant attempts to justify his assumption that there exists a good will apart from a good end, disappears utterly, and leaves his dogma in all its naked unthinkableness.

One of the propositions contained in Kant's first chapter is that "we find that the more a cultivated reason applies itself with deliberate purpose to the enjoyment of life and happiness, so much the more does the man fail of true satisfaction." A preliminary remark to be made on this statement is that in its sweeping form it is not true. I assert that it is untrue on the strength of personal experiences. In the course of my life there have occurred many intervals, averaging a month each, in which the pursuit of happiness was the sole object, and in which happiness was successfully pursued. How successfully may be judged from the fact that I would gladly live over again each of those periods without change, an assertion which I certainly can not make of any portions of my life spent in the daily discharge of duties. That which Kant should have said is that the *exclusive* pursuit of what are distinguished as pleasures and amusements is disappointing. This is doubtless true; and for the obvious reason that it overexercises one group of faculties, and exhausts them, while it leaves unexercised another group of faculties, which consequently do not yield the gratifications accompanying their exercise. It is not, as Kant says, guidance by "a cultivated reason" which leads to disappointment, but guidance by an uncultivated reason; for a cultivated reason teaches that continuous action of a small part of the nature, joined with inaction of the rest, must end in dissatisfaction.

But now, supposing we accept Kant's statement in full, what is its implication? That happiness is the thing to be desired, and, in one way or another, the thing to be achieved. For if not, what

meaning is there in the statement that it will not be achieved when made the immediate object? One who was thus admonished might properly rejoin: "You say I shall not get happiness if I make it the object of pursuit? Suppose then I do not make it the object of my pursuit; shall I get it? If I do, then your admonition amounts to this, that I shall obtain it better if I proceed in some other way than that I adopt. If I do not get it, then I remain without happiness if I follow your way, just as much as if I follow my own, and nothing is gained." An illustration will best show how the matter stands. To a tyro in archery the instructor says: "Sir, you must not point your arrow directly at the target; if you do, you will inevitably miss it; you must aim high above the target, and you may then possibly pierce the bull's-eye." What now is implied by the warning and the advice? Clearly that the purpose is to hit the target. Otherwise there is no sense in the remark that it will be missed if directly aimed at; and no sense in the remark that to be hit, something higher must be aimed at. Similarly with happiness. There is no sense in the remark that happiness will not be found if it is directly sought, unless happiness is a thing to be somehow or other obtained.

"Yes; there is sense," I hear it said. "Just as it may be that the target is not the thing to be hit at all, either by aiming directly or indirectly at it, but that some other thing is to be hit; so it may be that the thing to be achieved immediately or remotely is not happiness at all, but some other thing: the other thing being duty." In answer to this the admonished man may reasonably say: "What then is meant by Kant's statement that the man who pursues happiness 'fails of true satisfaction'? All happiness is made up of satisfactions. The 'true satisfaction' which Kant offers as an alternative, must be some kind of happiness; and if a truer satisfaction, must be a greater or better happiness; and better must mean on the average, and in the long run, greater. If this 'true satisfaction' does not mean greater happiness of self—distant if not proximate, in another life if not in this life—and if it does not mean greater happiness by achieving the happiness of others; then you propose to me as an end a smaller happiness instead of a greater, and I decline it."

So that in this professed repudiation of happiness as an end, there lies the inavoidable implication that it *is* the end.

This last consideration introduces us naturally to another of Kant's cardinal doctrines. That there may be no mistake in my representation of it, I must make a long quotation.

"I omit here all actions which are already recognized as inconsistent with duty, although they may be useful for this or that purpose, for with these the

question whether they are done *from duty* can not arise at all, since they even conflict with it. I also set aside those actions which really conform to duty, but to which men have *no* direct *inclination*, performing them because they are impelled thereto by some other inclination. For in this case we can readily distinguish whether the action which agrees with duty is done *from duty*, or from a selfish view. It is much harder to make this distinction when the action accords with duty, and the subject has besides a *direct* inclination to it. For example, it is always a matter of duty that a dealer should not overcharge an inexperienced purchaser, and wherever there is much commerce the prudent tradesman does not overcharge, but keeps a fixed price for every one, so that a child buys of him as well as any other. Men are thus *honestly* served; but this is not enough to make us believe that the tradesman has so acted from duty and from principles of honesty: his own advantage required it; it is out of the question in this case to suppose that he might besides have a direct inclination in favor of the buyers, so that, as it were, from love he should give no advantage to one over another [!]. Accordingly the action was done neither from duty nor from direct inclination, but merely with a selfish view. On the other hand, it is a duty to maintain one's life; and, in addition, every one has also a direct inclination to do so. But on this account the often anxious care which most men take for it has no intrinsic worth, and their maxim has no moral import. They preserve their life *as duty requires*, no doubt, but not *because duty requires*. On the other hand, if adversity and hopeless sorrow have completely taken away the relish for life; if the unfortunate one, strong in mind, indignant at his fate rather than desponding or dejected, wishes for death, and yet preserves his life without loving it—not from inclination or fear, but from duty—then his maxim has a moral worth.

"To be beneficent when we can is a duty; and besides this, there are many minds so sympathetically constituted that without any other motive of vanity or self-interest, they find a pleasure in spreading joy around them, and can take delight in the satisfaction of others so far as it is their own work. But I maintain that in such a case an action of this kind, however proper, however amiable it may be, has nevertheless no true moral worth, but is on a level with other inclinations" (pp. 17–19).

I have given this extract at length that there may be fully understood the remarkable doctrine it embodies—a doctrine especially remarkable as exemplified in the last sentence. Let us now consider all that it means.

Before doing this, however, I may remark that, space permitting, it might be shown clearly enough that the assumed distinction between sense of duty and inclination is untenable. The very expression *sense* of duty implies that the mental state signified is a feeling; and if a feeling it must, like other feelings, be gratified by acts of one kind and offended by acts of an opposite kind. If we take the name conscience, which is equivalent to sense of duty, we see the same thing. The common expressions "a tender conscience," "a seared conscience," indicate the perception that conscience is a feeling—a feeling which has its satisfactions and dissatisfactions, and which *inclines* a man to acts which yield the one and avoid the other—produces an *inclination*. The

truth is that conscience, or the sense of duty, is an inclination of a high and complex kind as distinguished from inclinations of lower and simpler kinds.

But let us grant Kant's distinction in an unqualified form. Doing this, let us entertain, too, his proposition that acts of whatever kind done from inclination have no moral worth, and that the only acts having moral worth are those done from a sense of duty. To test this proposition let us follow an example he sets. As he would have the quality of an act judged by supposing it universalized, let us judge of moral worth as he conceives it by making a like supposition. That we may do this effectually let us suppose that it is exemplified not only by every man but by all the acts of every man. Unless Kant alleges that a man may be morally worthy in too high a degree, we must admit that the greater the number of his acts which have moral worth the better. Let us then contemplate him as doing nothing from inclination but everything from a sense of duty.

When he pays the laborer who has done a week's work for him, it is not because letting a man go without wages would be against his inclination, but solely because he sees it to be a duty to fulfill contracts. Such care as he takes of his aged mother is prompted not by tender feeling for her but by the consciousness of filial obligation. When he gives evidence on behalf of a man whom he knows to have been falsely charged, it is not that he would be hurt by seeing the man wrongly punished, but simply in pursuance of a moral intuition showing him that public duty requires him to testify. When he sees a little child in danger of being run over, and steps aside to snatch it away, he does so not because the impending death of the child pains him, but because he knows it is a duty to save life. And so throughout, in all his relations as husband, as friend, as citizen, he thinks always of what the law of right conduct directs, and does it because it is the law of right conduct, not because he satisfies his affections or his sympathies by doing it. This is not all however. Kant's doctrine commits him to something far beyond this. If those acts only have moral worth which are done from a sense of duty, we must not only say that the moral worth of a man is greater in proportion as the number of the acts so done is greater; but we must say that his moral worth is greater in proportion as the strength of his sense of duty is such that he does the right thing not only apart from inclination but against inclination. According to Kant, then, the most moral man is the man whose sense of duty is so strong that he refrains from picking a pocket though he is much tempted to do it; who says of another that which is true though he would like to injure him by a falsehood; who lends money to his brother though he would prefer to see him in distress; who fetches the

doctor to his sick child though death would remove what he feels to be a burden. What, now, shall we think of a world peopled with Kant's typically moral men—men who in the one case, while doing right by one another, do it with indifference and severally know one another to be so doing it, and men who, in the other case, do right by one another notwithstanding the promptings of evil passions to do otherwise, and who severally know themselves surrounded by others similarly prompted? Most people will, I think, say that even in the first case life would be hardly bearable, and that in the second case it would be absolutely intolerable. Had such been men's natures, Schopenhauer would indeed have had good reason for urging that the race should bring itself to an end as quickly as possible.

Contemplate now the doings of one whose acts according to Kant have no moral worth. He goes through his daily work not thinking of duty to wife and child, but having in his thought the pleasure of witnessing their welfare; and on reaching home he delights to see his little girl with rosy cheeks and laughing eyes eating heartily. When he hands back to a shopkeeper the shilling given in excess of right change, he does not stop to ask what the moral law requires: the thought of profiting by the man's mistake is intrinsically repugnant to him. One who is drowning he plunges in to rescue without any idea of duty, but because he can not contemplate without horror the death which threatens. If for a worthy man who is out of employment he takes much trouble to find a place, he does it because the consciousness of the man's difficulties is painful to him, and because he knows that he will benefit not only him but the employer who engages him; no moral maxim enters his mind. When he goes to see a sick friend the gentle tones of his voice and the kindly expression of his face show that he is come not from any sense of obligation but because pity and a desire to raise his friend's spirits have moved him. If he aids in some public measure which helps men to help themselves, it is not in pursuance of the admonition "Do as you would be done by," but because the distresses around make him unhappy and the thought of mitigating them gives him pleasure. And so throughout: he ever does the right thing not in obedience to any injunction, but because he loves the right thing in and for itself. And now who would not like to live in a world where every one was thus characterized?

What, then, shall we think of Kant's conception of moral worth, when, if it were displayed universally in men's acts the world would be intolerable, and when if these same acts were universally performed from inclination, the world would be delightful?

I had intended to criticise, with kindred results I think, three

other cardinal points in Kant's doctrine; but am obliged to abandon the intention. A state of health such that the foregoing pages, commenced in the middle of March, I have been unable to complete till the first week in June, compels me now to desist.

## MOSSES AND THEIR WATER-SUPPLY.

By Prof. G. HABERLANDT, of Graz.

THE interest with which botanists regard the mosses is, for various reasons, more lively and more diversified than laymen might suppose so inconspicuous, unobtrusive a group could awaken. In more than one respect, they form a sharply marked point of departure for the morphological and phylogenetical study of the higher plants. The diversified forms of adaptation which these plants, and particularly the leafy mosses, exhibit in their outer and inner structure, are especially worthy of attention. From the fact that they exemplify so many different inclinations in respect to their local relations, and because, notwithstanding the variety in their forms, they are of relatively simple organization, the investigator's insight into their adaptive structure is made comparatively easy; and on more than one occasion their study has greatly aided the understanding of the adaptive phenomena of the more highly developed plants.

An instructive example of the way in which the observation of one order may be applied to facilitate the study of other orders, is afforded in the water-provision of the leafy mosses. Among the simplest in this category are those genera and species that grow on rocks, roofs, and tree-trunks, and are therefore most directly exposed to the rapid exhaustion of atmospheric precipitations. To these belong many *Hypnaceæ*—species of *Gymnostomum, Barbula, Orthotrichum*, etc. No special provisions for taking up water have yet been observed in these species. Their leaves all suck it in when it is abundant and swell out, and then completely dry up again as soon as the air has lost its moisture. It is not the taking in of water that interests us in these mosses, but their complete desiccation, which may occur again and again without harm to the vitality of the plant. In this is expressed a form of adaptation which is invisible to the investigator in microscopic anatomy, and which depends upon undetected properties of the protoplasm. It is evident that this kind of adaptation is most direct and effective, and is in exact conformity with the biological principle of economy of material, in that it makes special protective provisions for the prevention or retardation of the waste of water superfluous. The question arises, Why does this apparently advantageous pro-

tective property of adaptation to desiccation so rarely appear among the higher plants?—why have the plants of the steppes and deserts, for example, to protect themselves against the perils of drought by so various anatomical features, of thick skins, corky bark, waxy and hairy envelopes, receptacles for water, etc., instead of simply drying up and reviving again in the rainy periods? The answer to the question is not hard to find. The maxim, "one thing is not suitable for all," is valid in the biological domain. That which works well in the little mosses is for various reasons not available to the larger phanerogams. First, the larger plants must continue to vegetate actively for longer periods, in order to prepare the amount of food required for the proper growth of their organs. Ever-recurring interruptions of their feeding by drying out would so retard the whole process of their growth, that in spite of their vital tenacity they would be at a great disadvantage in the struggle for existence. To this is added another not less weighty reason, that the mosses are so simple in their anatomical structure that the mechanical shrinking of the drying tissue involves no danger; the collaborated cells easily resume their original form and size on the accession of a new water-supply. It is very different with the organs, far more complicated in their structure and composed of tissue of diversified kinds, of the more highly developed plants. In them extensive shrinkage would result in damaging tensions and distortions, and even cracks, for the limitation of which various mechanical protective adaptations would be required. Besides this, the mechanical structure of the tissues would have to have a proportionately enormous development, else the dry, brittle leaves and branches would be broken up by every gust of wind. A careful regard to the consequences of such an adaptation to complete desiccation should be sufficient to convince any one that it would be too dearly purchased. But in the case of many of the humbler plants insensibility to continuous desiccation is a life-question, and accordingly they have practically acquired that property. It is of equal interest from a physiological and a biological point of view that the protoplasm of the young individual should, by further development, gradually suffer the complete loss of so pregnant a property as that of reviving after it has been dried up.

The power of the mosses to endure repeated desiccation has recently been experimentally treated by G. Schröder,* who obtained the interesting result that many of these plants can not only resist months of dryness without any harm, but also that they do not perish even under the strongest desiccation carried on in a drier with the aid of sulphuric acid. Plants of *Barbula*

* "Ueber die Austrocknungsfähigkeit der Pflanzen." Untersuchen aus dem botanischen Institut zu Tübingen. Published by Pfeffer. Vol. ii, part i, 1886.

*muralis*, which were exposed for eighteen months in the drier, after a few wettings resumed growth in all their parts. Other species of *Barbula* behaved similarly. A curious experiment was performed with *Grimmia pulvinata*, in which a stock which had been cultivated for some time in a moist atmosphere under a bell-glass was suddenly exposed to a warm and perfectly dry current of air. It became so dry in a short time that it could be pulverized. Then it lay in a drier for ninety-five weeks. But the quickening moisture was still competent to awaken it to renewed life. The most rapid drying which could be performed in the laboratory could not destroy the plant. It even showed greater power of resistance than would correspond with its real necessities, for so speedy and complete a drying out as was effected in the experiments never occurs in Nature. The fact that a property acquired by adaptation is so plainly manifested in excess is sometimes otherwise demonstrable, and is a hard problem for the theory of selection.

Those mosses which are not capable of drawing water in considerable quantities from the soil, are yet able to make the best use of the smaller quantities with which they are moistened. For this object their stems are furnished with provisions for the capillary distribution of the local water with which they are in contact. This capillary "outer water-conduit" was perceived several years ago in various mosses by C. Schimper; and it has recently been more closely studied with the aid of colored solutions by Fr. Oltmann.

The capillary spaces in which the water rises or, more generally speaking, diffuses itself, exist in different forms. In the simplest cases the leaves supply them; and of this kind there are, according to Oltmann's comparisons, several types. Thus in *Hylocomium loreum*, *Hypnum purum*, and similar forms, the leaves are so shaped and arranged with their opposite sides in close contact as to form a hollow cylinder around the stem, which is composed in its interior of a system of connected chambers. When enough water is present, the capillary space between the stem and the leaf is quite full; in other cases the water ascends only between the overlapping leaf-edges. In *Plageothecium undulatum*, *Neckera crispa*, etc., the leaves lap like shingles; in other cases they are small and thickly packed, so that a whole system of narrow capillary spaces is generated between them. The frequently observed phenomenon of the drying leaves erecting themselves and lying close to the stem, with wrinklings and curlings, involves, as Oltmann has remarked, an increase of capillary space. By these means the water, when a wetting takes place, is diffused more readily and completely over the surface of the plant.

In another series of cases, the capillary apparatus is formed by

a felting of hairs encompassing the stem, in which water rises as in a piece of filtering paper. *Dicranum undulatum*, *Climacium dendroides*, and *Hylocomium splendens* are among the species thus furnished. These hair formations commonly resemble the root-hairs, and might eventually be designated as of that class; but in single cases, as in *Thuidium tamariscinum*, they exhibit a peculiar construction. The hairs are undoubtedly adapted to taking up the water with which they come in contact.

With the phanerogams, the plenteous absorption of water by organs above ground is a rare phenomenon of adaptation, and is limited to a number of epiphytes (*Bromelaciæ*) and desert-plants. In these, again, different forms of hair-growth assist the reception of water. Volkens * has recently shown that many of those desert species whose leaves are furnished with a hair-felting absorb rain and dew in this manner. But he has never observed the reception of the water going on over the whole surface of the hair, but only in specific cells at the base of the hair which act as the absorbing element; while the dead cells composing the felt fulfill the purpose of retaining the water, covering the surface of the leaf, and in that way facilitating absorption.

The capillary apparatus of the peat-mosses is peculiar and without any analogies with the more highly developed plants. The leaves of the *Sphagnaceæ* consist of two kinds of elements; of long-drawn, chlorophyll-bearing cells woven into a net-work, and of dead, colorless capillary cells, which form the meshes of the net. The walls of the capillary cells are furnished with large, usually round pores, the points at which the water is admitted, the situation and arrangement of which in many species materially facilitate the passage of the water from one cell to another. The edges of the pores are usually hemmed with a thicker fibrous ring, the office of which is evidently mechanical, or to prevent tearing. The walls of the cells are also stiffened with spirally arranged fibrous structures, like the duct-walls of the more highly developed plants. The stems of the peat-mosses have also a "bark-envelope" from two to four cells thick, which serves as a reservoir and a medium for the circulation of water.

The stems, fruit-stalks, and leaves of numerous mosses possess a water-bearing tissue-cord occupying an axillary position. This cord, which consists of narrow, thin-walled, and elongated cells, has been described by W. Ph. Schimper and Fr. Unger, to whom we owe some excellent researches on the anatomy of the mosses. Its precise physiological function has until very recently not been made clear. While it was not doubted that it had some connection with the circulation, it was not certain whether or not it presented any analogies with the vascular system of the higher

* "The Flora of the Egypto-Arabian Desert." Berlin, 1887, p. 32.

plants. I have within a short time obtained evidence that the typical tissue-cord represents a water-bearing structure. With a solution of sulphate of lithium I found that the average velocity of the circulation through the central cord was not very far behind that which took place in the stems of phanerogamous plants; and that the solution was very quickly transferred from the central cord through the leaves. Experiments in transpiration further showed that the water-bearing capacity of the central cord, where it is well developed, is amply sufficient to supply the water lost by transpiration.

It is a point of interest with respect to the relations between the structure of the central cord and the local conditions of the habitat of the plant, that only those mosses that grow on more or less moist ground have this cord well developed. It is easy to perceive that the cord can be of advantage only where a steady supply and circulation of water for a relatively considerable length of time is possible. To classes fulfilling these conditions belong chiefly the longer leaved and therefore more actively transpiring plants of Mnium, Bryum, Bartramia, Funaria, Fissidens, and Splachnum. On the other hand, the systematic position of the moss appears to be a matter of no account. *Archidium alternifolium*, which grows in moist fields, and which is phylogenetically regarded as one of the lowest of the leaf-mosses, has a typically developed central cord. It is, therefore, plain that the central cord indicating the formation of a water-bearing tissue in the leaf-mosses is in no way a sign of higher phylogenetic structure, but is wholly a mark of adaptation.

The mosses living in dry places form another biological group. Their stems possess either no or only very weakly developed central cords, which seem to have suffered degeneration. They are apparently the predecessors of the mosses of which we have just spoken as inhabiting moist situations, and which are furnished with typically constructed central cords. Mosses growing in water, likewise, for reasons easily to be understood, possess no or strongly degenerated central cords, and in this respect are analogous with submerged phanerogamous plants, in the leaves and stems of which the water-bearing system appears to have undergone a more or less extensive atrophy. Finally, those mosses in which an external circulation of water occurs are unprovided with a central cord, or present it in a very reduced form.

In the most highly developed mosses, the *Polytrichaceæ*, the central conducting bundle of the stem consists no longer of water-bearing tissues only; just as in the conducting bundles of the ferns and phanerogams, the vascular tissues for carrying plastic growth-food are combined with the water-ducts into a single system.

When we survey the different kinds of water-provision among the mosses, we are struck with the variety of ways of adaptation that have been developed for the attainment of the same end. In so small plants, the demands upon the efficiency of the water-bearing apparatus are likewise quite small, and the choice among them is only slightly limited. The larger the plant-forms become, the greater the demands made upon the water-bearing system, the more plainly appears the diversified efficiency of the adaptation henceforth possible, till at last there remains to Nature a single available model, which she applies with certain variations everywhere that large, stately plant-forms are produced.—*Translated for the Popular Science Monthly from Humboldt.*

## INJURIOUS INFLUENCES OF CITY LIFE.

By WALTER B. PLATT, M. D., F. R. C. S. (Eng.).

WE do not intend to discuss in this paper the subjects of bad ventilation and impure air, imperfect drainage, damp cellars, or insufficient nourishment. Residents of the country may suffer from all these as well as dwellers in cities. There are, however, certain injurious influences more insidious in their operation, which are peculiar to cities, and affect the well-to-do as well as the poor, although not in equal degree. I believe these lead, sooner or later, to degeneration of the individual and his offspring, by producing progressive feebleness, and to ultimate extinction of such families as are long subjected to their force. I refer to those which chiefly affect the stability of the nervous system, rendering it less capable of sustained work, and, in a secondary way, only the circulation and general nutrition. The end-result of all these influences is to lessen the producing power of each man, and thus to depreciate his value as an economic factor. They ought not to exist if their removal be possible, and if it can be effected without greater expense than their ill effects warrant. Their cause is to be found in faulty municipal arrangements which can be largely corrected by intelligent action and supervision. They work by producing insomnia, aberrant forms of mental action, singling out those who are less strong as subjects of the so-called neurasthenia.

These effects accumulate with each successive generation subjected to their influence, until the final inheritor finds the load too heavy to bear and do any useful work. The ne'er-do-wells and idlers are often, not always, such, from actual inability for persistent effort. Let us see if such influences exist, if they are injurious

to any considerable extent, and if it is practicable to remove or modify them.

We refer chiefly to three, and these are: 1. Disuse of the upper extremities for any considerable muscular exertion. 2. The incessant noise of a large city. 3. Jarring of the brain and spinal cord by continual treading upon the stone and brick pavements which make our sidewalks and streets.

We leave out of the question those to whom these observations do not apply—viz., such as are able to spend nearly half the year out of town. Experience has shown that such individuals and families suffer in small degree from an ordinary city life; while, on the other hand, good authorities assert that there are very few families now living in London who, with their predecessors, have resided there continuously for three generations.

If there is one general physical difference between the country-bred and the city-bred man, it lies in the size and strength of the muscles of the shoulder and arm. It is almost impossible for a man to live in the country without using the arms far more than the average city man. This use of the arms has, in both men and women, an important bearing on the general health, since it increases the capacity of the chest, and thereby the surface of lung-tissue where the blood is spread out in thin-walled vessels through which the oxygen and carbonic acid easily pass in opposite directions, serving thus the double purpose of feeding the body more abundantly and of removing a constantly accumulating waste product.

This richer blood is again driven with greater force by increased heart and arterial action through its circuit. The vital organs are better nourished and the power to produce work is increased.

Few will deny that a well-nourished body can be trained to do more and better mental work than the same organism in a feebler state. Walking on an even surface, the only variety of physical exercise which most business and professional men get in town, is well known to be a poor substitute for arm-exertion. The reason is partially plain, since walking is almost automatic and involuntary. The walking mechanism is set in motion as we would turn an hour-glass, and requires little attention, much less volition and separate discharges of force from the brain-surface with each muscular contraction, as is the case with the great majority of *arm*-movements.

The arm-user is a higher animal than the leg-user. Arm-motions are more nearly associated with mental action than leg-movements. A man's lower limbs merely carry his higher centers to his food or work. The latter must be executed with his arms and hands.

A third way in which arm-exercise benefits the organism is

through the nervous system. Whether this is due to an increased supply of richer, purer blood, or whether the continual discharge of motor impulses in some way stores up another variety of force, we do not know. One thing is certain, the victim of neurasthenia is very seldom an individual who daily uses his arms for muscular work; with this, the limit of hurtful mental work is seldom reached.

It seems evident that arm rather than leg movements are essential to increased productive power. If these are neglected, the man as a social factor degenerates and falls a prey to his stronger fellow-man in the race for supremacy and productiveness. It may be remarked that American gout, that condition of the blood which causes our English cousins pain in their feet, and Americans universal pains and increased irritability, has one sovereign remedy so simple that few will take it, and this is daily systematic arm-exercise. It is Nature's sedative, for which she charges nothing the next day, but gives us sleep instead of insomnia, and cheerfulness in place of discontent. A man may walk in an hour four miles, on a city sidewalk, and reach his desk tired, exhausted of force, and better only for the open air and a slight increase of the circulation. Had he spent half that time in a well-ordered gymnasium, using chest and rowing-weights, and, after a sponge-bath, if he had gone by rapid transit to his office, he would have found his work of a very different color, easier to do, and taking less time to perform it. The view for some time held by Hartwell, of the Johns Hopkins University, Sargent, of Harvard, and others, that arm-exercise prevents or does away with nervous irritability, and at the same time increases the absolute capacity for mental work, has not been sufficiently urged or accepted.

The remedy for this state of things is to cause every man and woman to realize the importance of arm-exercise. Make it compulsory in schools, and popular after leaving school. If one's occupation does not require it in itself, muscular exertion of some kind ought to be taken daily, with the same regularity as food and sleep, for all three are necessary to the fullest development of our powers.

A second injurious influence, which pertains exclusively to city life, is incessant noise. This may not be very intense at any time, but, when continuous, it acts as certainly upon the nervous system as water falling upon a harder or softer stone. Recent experiments upon animals subjected to the sound of a continuously vibrating tuning-fork for a number of hours, one or two days in all, show that the first effect is that of an irritant to the nerve-centers, as certainly as an acid or an electric shock is to muscle-fiber. A secondary visible effect is opacity of the crystalline lens of the eye.

The noise of a city is at first painful and confusing to one unaccustomed to it. We do not maintain that a really bad effect is at once apparent upon most individuals. When people are subjected to such a variety of influences, it is difficult to isolate and measure the result of one. Not infrequently a change from a noisy to a quieter part of the town is most beneficial to especially sensitive individuals. Much noise is unnecessary to the performance of most useful work. It means waste, wear and tear in the majority of cases.

The most perfect are the most noiseless machines, and this applies to the social organism as well. The rattle of badly built wagons over poor pavements, the ringing of milkmen's bells, or the jangling of those on street-cars, street cries, and the like, have long been recognized as evils in European cities, and suppressed in many places. In certain streets in Berlin heavily laden carts and wagons are never allowed, and in others only when the horses walk. In Munich the street-cars have no bells. Recently in New York a measure has been under favorable consideration to abolish the ringing of milkmen's bells, and to have those on street-cars taken off. The immense relief to the residents of a street in Baltimore, where the cars run every three minutes in each direction, when the bells were omitted for several weeks on account of sickness in that street, will not soon be forgotten.

Every one will instinctively call to mind boiler-makers and workers in factories as instances where men work for years in incessant din without injury. These are instances like those of pearl-divers and miners, and show rather what can be endured by some than what is best for most. On the other hand, we have all known individuals in whom slight noises cause absolute pain. The blowing of locomotive and factory-whistles within city limits has been abolished in some of our largest municipalities. The loud ringing of church-bells at all hours of the day and night, in this age, when every one knows the hour of prayer, hardly recommends the religion of good-will to men. All these unnecessary noises add more weight to the overtaxed nervous systems of many men and women who can not escape them. It is certain that with the increasing intensity of city life, and its consequent strain, such things must be lessened, as far as compatible with business interests. Suitably enforced municipal regulations can do this. Elevated railroads should not be permitted in streets where men and women live, underground roads should take their place where it is possible. Certain streets, or blocks at least, should be reserved for business purposes, others for dwellings alone, and heavy wagons allowed only in the first named, unless they are to leave their freight in the block. Rattling irons and chains should not be allowed. Pavements should be thoroughly

laid and then kept in repair. Londoners find asphalt the best pavement for all but the very heaviest traffic, in spite of its being very slippery in wet weather. The advantages far outweigh this one disadvantage. Horses can draw much heavier loads than on Belgian block, with less noise, while they are the cleanest pavements known. Those called asphalt pavements in America are a poor imitation of what our English brethren enjoy. Intelligent, honest city government, in a word, will give us health as well as increased business facilities.

Jarring is an equally hurtful influence of city life that has not received the attention it deserves. Combined with the two preceding, it completes a formidable trio. Very few realize the fact that we who were designed to tread upon soft Mother Earth have become a race of dwellers upon rocks and stones. In walking, the jar of the fall of our one hundred and fifty pounds comes entirely upon the heel, since it first strikes the ground. The ball of the foot and the instep serve only to raise us for another downfall —small, it is true, but equal to the weight of our bodies falling through one half to one inch in a little less than one second. This shock would be sudden and unbearable but for the arrangement of the bones, muscles, and ligaments of the lower limb. The chief elastic distributing springs are the mass of muscles on the front of the thigh and that on the front of the leg. These deaden the shock much as two great India-rubber bands. The ankle and hip-joints help but little, while the curves of the spine and the disks of cartilage between the vertebræ aid a great deal in lessening the impact of the body with the ground.

This shock in ordinary walking is less than if the body be raised one half or three quarters of an inch on the toes, and then suddenly let fall upon the heels, since the limb which is put forward is somewhat like the spoke of a wheel, if we imagine a wheel consisting of an axle and spokes alone. The brain bears almost the same relation to its containing bony case, the skull, that the ball does to the cup, in the old-fashioned cup-and-ball, where the ball is tossed into the air and caught in its cup with a sharp shock.

If any one doubts that there is a distinct and decided *jar* of the brain with each step, let him walk a hundred yards when the brain is slightly over-sensitive from a bad cold or headache, and he will observe the pain each step causes. Or, more scientifically, let him place (as I did recently) a pedometer inside his hat, and it will register every time his heel strikes the ground.

Fortunately the brain, in health, does not perceive these slight jars to its own substance, and interpret them as pain. Nature provides one more anatomical precaution against jarring by slinging up the brain in its spherical hammock, the dura mater. Now, in many people, the ill effect of these thousands of slight daily con-

cussions accumulate, and after a time concur with other causes in producing that state of disability called nervous exhaustion. An observant man may see on one side of any stone or brick sidewalk in the city wherever there is soft ground near by, a well-worn path which will be instinctively chosen by pedestrians. If we test ourselves we shall find the chief reason of our choice is because it jars us less to walk there than upon stones and bricks.

Most healthy men endure these concussions for a long time without very serious effects, while others who suffer from them are entirely restored by enforced rest, provided the circulation be at the same time maintained. It is not improbable that some of the long cobweb-like processes of the nerve-cells are damaged by being shaken for months and years over city pavements.

Statistics upon such a matter are almost out of the question where insufficient exercise, noise, and jarring of the nerve-centers combine with other influences to overthrow the individual or to lessen his productive powers.

If it be then injurious to some to walk daily for years upon stones and bricks, and less so upon earth or softer material, this can be remedied in two ways. First, by changing the material of our sidewalks to a more elastic one. Something is needed for pedestrians which will be durable, yet not hard. Some of the varieties of asphalt composition are elastic, but none of them sufficiently durable, as far as I know.

Nature suggests a remedy in a second way, in the covering of the human heel itself where we find a very elastic pad one half an inch thick, to lessen the jar of walking. If we replace the perfectly hard boot-heel by an elastic India-rubber one, we provide an inexpensive and practical remedy, which it would cost the wearer but a few cents a month to keep in repair. This cover has the additional advantage of lessening the noise of hurrying feet, and preventing broken bones in the winter season. If now our city authorities will, at some future time, provide gymnasia as well as libraries and parks, make our large towns quiet as well as clean, and give us sidewalks more like Mother Earth, we believe such a favored community will produce more, and lead collectively a happier life, than most of our modern towns.

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ARGUMENTS in behalf of Sunday observance, based upon grounds of religion or custom, or even upon the desire of certain classes of people to have one day of quiet, are not usually effective with those to whom they need to be addressed, for they care but little for these things. It may be a more potent argument that the conversion of Sunday into a day of pleasure is likely to injure those who work hard during the week, by forcing or tempting them to work on Sunday as well. There is no doubt as to the increase of Sunday labor during recent years, and it is very largely attributable to the increase of Sunday amusements.

## SOMETHING ABOUT SNAKES.

By C. T. BUCKLAND, F. Z. S.

IN writing about snakes an apology must be offered for beginning with what may seem to be a boastful statement; but it is unavoidable, as it is my chief justification for putting pen to paper.

Therefore it must be avowed that, to the best of my knowledge and belief, the snakes have never had a worse enemy than they have found in me, and it came to pass in this way. In the year 1856–'57, being one of the secretaries to the Government of Bengal, I obtained the consent of the Lieutenant-Governor, Sir Frederick Halliday, to the issue of an order authorizing the payment of a reward of sixpence for every poisonous snake whose dead body should be produced before a district magistrate in Bengal. This was the beginning of the campaign against snakes in India, and my hand was responsible for it. It was subsequently backed up by the influence of Sir Joseph Fayrer, the greatest living authority on snakes. From that day forth, with occasional intermissions, the system of giving rewards has spread from province to province, until the total number of venomous snakes killed throughout British India in 1886 exceeded four hundred thousand. If it be admitted that, during the last thirty years, the average number of poisonous snakes killed has amounted to only one hundred thousand per annum, a child can calculate how many million snakes have to denounce me as the originator of the mischief and crusade against them.

Why, it may be asked, was such wrath against snakes kindled in me? The explanation is peculiar, and may not be the true one, but it happened that when I was a very small child, my mother's brother, the Rev. Matthew Arnold,* was bitten on the ankle by a viper at Slatwood's, in the Isle of Wight, and the story went that his life was in great danger, the whole of his body turning black gradually from the feet upward, until the blackness came as high as his heart, when it stopped and began to abate, until it gradually disappeared as the virulence of the poison wore out. This story made a grave impression on the juvenile minds of myself and my brothers. Not long afterward we were taken to stay with an aunt at Eaglehurst, in Hampshire, and somewhere down on the beach, toward Calshot Castle, I found a snake lying on the grass, which, being an "animosus infans," I picked up and brought to our nurse. Luckily for me the snake was dead, but according to the fashion of those days I was afterward soundly flogged, to teach me not to play with snakes again. From either of these

* Brother of Dr. Arnold.

causes it may have come to pass that an antipathy to snakes was engendered in my heart.

My cousin Frank Buckland, with whom I was for some time at school as a boy, had a fondness for keeping snakes in his pockets, which was not shared by his schoolfellows, including me. However this may have been, I have little recollection of anything about snakes at that time, except that when I was a boy at Eton there was a large snake exhibited one year at Windsor fair, which pleased our juvenile fancy, as we were glad to see a snake as described by Virgil *positis novus exuviis*, and we were delighted to buy, for a very fancy price, a piece of the old skin that it had shed. The next time that I met a snake the meeting was bad for the snake. A friend was driving me in his buggy in the suburbs of Calcutta with a fast-trotting horse, when a large snake tried to cross the road in front of us. But the horse, not seeing or not heeding it, trotted on, and a wheel of the buggy cut the snake in half. We pulled up to examine the remains, and it turned out to be only a large but harmless water-snake.

It is hardly credible how long a time a man may live in India without seeing snakes in his house, unless he looks about diligently for them. Of course there is more chance of seeing them out of doors, and especially out snipe-shooting, as the snake is an amphibious sort of creature, with a special appetite for a juicy young frog, whose home, not always a very happy one, is in the rice-fields. What with the long-legged birds of the crane species that stalk through the water, and the snakes who glide about in the mud, or lie on the little earthen ridges which divide the rice-fields for irrigation purposes, the frogs have a bad time of it. One afternoon I was walking along one of the earthen ridges between the rice-fields, looking for snipe on either side of me, when a few yards in front of me there reared up three cobras, facing me with hoods erect, and evidently "meaning venom." I fired a charge of snipe-shot into them, and there was a great confusion of heads and tails and bits of bodies, so that it would have been hard to put a whole snake together again. This gave me a useful lesson to keep a good lookout. One day I was out shooting with a friend who trod on a snake, which promptly curled round his leg and tried to bite through his gaiter. His gaiter was perfectly snake-proof, but he did not think of that, and his efforts to shoot the snake without hitting his own leg were so ludicrous that it was hardly possible not to laugh, until we could hit the snake on the head with a loading-rod and make it quit my friend's leg.

Once we were spending a holiday at a little bungalow at the seaside, to which we used to go occasionally for change of air, and sea-bathing if the tide permitted it. We were walking along the sandy beach, when we saw a large cobra, about five feet long, with

a bird in its mouth, making off through some light bushes, where it had probably seized the bird, though it had not had time to swallow it. We very soon disabled the snake by a blow on the back; but as it was by no means dead we secured it with a small rope, and dragged it into the portico of the bungalow for the sake of trying experiments with it. We sent for one of the numerous village dogs called pariahs, but the snake would not look at the dog. A fowl was then brought and placed with its legs tied, near the snake's head. The snake revived a little, and made a dart at the fowl, but the bird evaded it, and struggling to its feet it gave the cobra a fierce peck on the head, which quite decided the battle. The fact was that the snake was too much injured by the blow on the spine that had disabled it; and, moreover, it had probably spent its freshness and most deadly venom in killing the small bird which it had seized before we saw it. Many years afterward I saw a cobra bite a fowl, and turned to look at my watch to see how long it would be before the poison took effect. As I looked back again toward the fowl it fell down quite dead, within thirty seconds from the time it was bitten. This occurred in the house of a friend who had engaged an itinerant snake-charmer to exhibit snakes to a party of guests. Several cobras, deprived of their poisonous fangs, had been exhibited in the usual manner, when the snake-charmer stated that he had with him a snake of which the poisonous fangs were intact, and he offered to show it. He dealt with it very carefully with a forked stick in producing it from a basket, and he was equally cautious when he placed the fowl near enough to the snake to be bitten by it. What the result of the bite was to the fowl has been already told. There can be little doubt that if this cobra had managed to bite its keeper or any of the spectators, with its fangs fully charged with fresh venom, it would have been almost if not quite impossible to save their life.

It is always expedient in India to have a dog or a cat or a mungoose (a sort of ichneumon) about the house to keep away snakes, or to draw attention to them when they are crawling about. My wife's dog probably saved her life by barking at two snakes which had got into her dressing-room. A cat with kittens once drew my attention, by her extraordinary antics, to a large cobra, which she was trying to keep away from her young ones. The mungoose is the professional enemy of the snake, and goes for him at once to kill him, and perhaps to eat him. There is no valid foundation for the belief that the mungoose has recourse to an antidote to protect itself against a snake's venom. The mungoose relies on his own agility and sharp teeth, and on the coarse hair of his skin, which will avert most snake-bites. But if the snake gets well home, so as to lodge his poison in the mungoose's skin, that mungoose will surely die. It is not dissimilar to the case of the com-

mon village pigs in India, which are well known as scavengers and carrion-eaters. They will kill and eat any snake that comes in their way, and the hide of their hard and hairy bodies and legs is almost snake-proof. But if a cobra bites a pig on a soft place, so as to plant his poison under the skin, that pig will surely die.

The python, or boa constrictor, is comparatively common in Bengal, and sometimes grows to a great size. The first one that I saw was said to be twenty-four feet long, but it had been dead for several days, and the stench from it was longer than the street in which it was being exhibited to a crowd of admiring natives, and I could not venture to measure it. I saw another, which was said to be twenty-one feet long, being carried dead through the street of Dacca, but was unable to stop to measure it for myself. An officer, whose veracity I did not mistrust, told me he had found one in Cachar twenty-five feet long, which had committed suicide by swallowing a buck hog-deer, of which the horns injured and cut through the intestines of the snake before the gastric juices could soften the horns. There was a plentiful supply of pythons at the Zoölogical Gardens in Calcutta. One large one, which measured nearly eighteen feet, sat most patiently for more than a month over a batch of its eggs, and it was hoped that her perseverance and motherly affection would be rewarded by a young brood. But for some unknown reason the eggs were all addled. During her long incubation the mother snake was never seen to quit her eggs; and she would take no kind of food, although rats and chickens were offered to her from day to day.

It is not every one who has seen a python take a meal. It is usually averse to dead food; but it is very partial to a live rabbit or a chicken or a guinea-pig or by preference a rat. The python seems to know that the rat will try to escape, and he gives it no time or quarter. With a rapidity that can hardly be conceived, he seizes the rat with his mouth, and the fatal coil passes round the creature, squeezing all life out of it, and reducing the body to the form of an elongated sausage, which the snake lubricates with its own slime and swallows entire. If a fowl is put into a python's cage, the snake sometimes seems to take no notice, and the frightened bird, finding that no harm comes to it, begins to ruffle its feathers and to peck about, occasionally trying its beak on the snake's skin. But after a while the end of the python's tail may be seen to quiver with a strange emotion, while the small black beady eye is fixed upon the fowl. Suddenly there is a convulsion. The snake has moved and the fowl has disappeared, and can only be discovered by the end of a feather or two protruding from the coils in the python's neck which have crushed the bird's life out. In its natural state the python will catch a deer or a wild pig, and crush it in the powerful coils of its neck. There is a well-authen-

ticated story of a large python having caught two wild sucking-pigs simultaneously, crushing both with the same coil of its neck. In the case of the python mentioned above, which was killed by the horns of the buck that it had swallowed, the snake must have been able to break all the bones of the body, but the stag's horns were probably too sharp and pointed to be easily crushed, and the snake rashly took the chance of digesting them in its stomach. No stories of a python killing a man ever came to my knowledge, but one of the keepers at the Calcutta Zoölogical Gardens had his arm much injured one morning by a python coiling itself on it and squeezing it severely before the man could be rescued.

It has been mentioned that large rewards are paid throughout India for killing venomous snakes. The actual number of snakes for which rewards were paid in 1886 was 417,596, and the sum paid was 25,360 rupees, which is a little more than a penny each in the depreciated silver currency. These rewards are almost invariably paid, or ought to be paid, by the English magistrates themselves, after examining the dead snakes. Numerous attempts are made to pass off harmless snakes as poisonous snakes; and a highly educated native official will rarely condescend to allow a dead snake to come too closely between the wind and his nobility, to enable him to distinguish between the poisonous and the non-poisonous snakes. If the rewards were not paid by an English officer, a considerable portion of them would probably be intercepted by unscrupulous native subordinates before they reached the man who killed the snake.

When the Duke of Argyll was Secretary of State for India, he, as a student of natural history, took a special interest in the question of killing poisonous snakes. And there came to him one day at the India Office the cunning inventor of a machine called an asphyxiator, by which it was easily demonstrated that the snakes could be killed in large numbers in the holes in which they dwell in India. It was not difficult to show to his grace that when the asphyxiator was applied to a rabbit-hole the rabbit must either bolt or be suffocated. The snake would be treated in the same way as a rabbit. So the duke ordered some twenty asphyxiators, and sent them out to different parts of India. It happened that I was employed near Calcutta, and the Government of Bengal were pleased to order me to make a trial of the consignment of asphyxiators, which they regarded as so many white elephants. The asphyxiators were unpacked, and the instructions which accompanied them were read. There was a sort of fire-box in which a pestilently smelling paper was to be burned. There was a wheel to be turned, so as to send the smoke from the burning paper through a funnel into a long nozzle which was to be inserted into the snake's hole. This, it will be seen, required the services of two

men, one to keep up the fire and turn the wheel, and the other to direct and hold the nozzle-pipe. It was also requisite that a third man should stand by with a stick, to kill the snake bolting from its hole. We turned out with the apparatus properly manned, lighted the fire to get up smoke, and applied the nozzle to a hole in a bank near the stable, which was supposed to hold a snake. The smoke was injected, and out there bolted a terrified rat. The man with the stick struck at the rat and broke the nozzle-pipe. The man at the nozzle-pipe jumped back against the man who was turning the wheel, and in their fright they both tumbled down. The rat escaped, but if it had been a snake instead of a rat it is very probable that one of the three operators might have been bitten. The men lost confidence in the machine, and declined to work it. It was taken indoors, and put into an anteroom, where the native night-watchman usually took up his quarters. One cold night the watchman closed the doors of the room and lit a quantity of the medicated paper to warm himself. In the morning a well-asphyxiated watchman was found, but luckily he was brought round with deluges of cold water. This, however, was the end of the official career of the Duke of Argyll's snake-asphyxiator in Bengal.

Although most people have a natural aversion to snakes, and would on no account touch them, there are some persons who are accustomed to handle snakes (*tractare serpentes*), and will pick up a wild poisonous snake from the ground with impunity. George Borrow, the author of "The Gypsies in Spain," had this faculty; and I knew two officers, one of whom was a captain in a Scotch regiment, while his brother was the doctor, who said that this faculty of handling snakes had been born in them. In a work published not long ago by Mr. F. B. Simson, a retired Indian civilian, he gives the following prescription for catching cobras: "When you come upon your cobra, make him rear up and expand his hood. He generally does this quickly enough; but should he delay, whistle to him, imitating the snake-charmers. He will then certainly raise his head. Then with a small cane or stick, or the ramrod of a gun, gently press his head to the ground. The snake will not object; he seems rather to like it. When you press his head lightly to the ground with the stick in your left hand, you should seize the snake firmly with your right, close behind the head, holding his neck rather tightly; then let go the stick and catch hold of the tail. The snake is powerless, and you can do what you like with it. You should have an earthen pot brought and let the snake pass into it, as snakes will always go into any dark place." On the whole this prescription does not seem inviting. I have never tried it, and should hardly care to see any one try it.

Mr. Simson says that he had an elephant-driver, or *mahout*, who was a great snake-catcher and very reckless. He writes thus: "I never saw him press down the snake with a rod such as I have described, but he caught numbers of snakes of all sorts, and sent them alive to his house. His movements were so rapid, and generally in jungle and with his back to me, that I never made out exactly why he did not get bit. He used to jump off his elephant, leaving the animal in my guidance; in a moment afterward he had the snake's neck in his hand. He said that he caught them by their tails, swung them under his arm, and held them there, while he slipped his hand up to the back of the head. He then gave the snake some of his clothing to amuse himself with, and on which to expend its venom. He then wrapped the reptiles up in a loose cloth and took very little trouble with them. I have seen him catch snakes scores of times, but I rather discouraged him, as I did not like the idea of having live venomous snakes at large, or even in earthen pots or boxes. At the same time he received good prices for his snakes."

Some people who are used to handle snakes seem to lose all feeling of apprehension regarding them. Sir Joseph Fayrer, whose work styled "Thanatophidia" contains the most perfect colored plates and descriptions of the principal venomous snakes, had no fear of them. But he was very nearly bitten one day. He and a friend were busy examining the peculiar anatomy of a portion of a cobra's tail. The cobra was in a box, and a native assistant was supposed to be holding down the lid of the box so as to allow only the tail to protrude. Somehow the native became careless, and he relaxed his hold on the lid, so that the cobra suddenly put out its head to see what Sir Joseph Fayrer was doing with its tail. Luckily it was more pleased than offended at the liberties which were being taken with its tail, but it was unpleasant for Sir Joseph Fayrer to find his face almost touching the cobra's mouth. Dr. Richards was another officer who assisted Sir Joseph Fayrer in his experiments with snakes. Dr. Richards came one day to see a lady patient at my house. He arrived in a palanquin which was put down in the portico. He went to the lady's room and paid her a brief visit; and when he came out of the room he went to the palanquin and brought out a large cobra which he had brought over to show me, in order to prove by experiments in my presence that a particular kind of wood, which a native fakir declared to be an antidote to snake-poison, was of no value. It is unnecessary to recapitulate the experiments, but his familiarity with the deadly snake was quite alarming. I could not help wondering what his lady patient would have said if she had known that he had brought a snake with him to the house, for she was terribly nervous about snakes.

The snake-house in the Zoölogical Gardens in the Regent's Park is a most perfectly designed building for keeping the snakes in health, and for exhibiting them to the public. The late King of Oude had built a snakery in the gardens of his palace at Garden Reach, near Calcutta. It was an oblong pit about thirty feet long by twenty feet broad, the walls being about twelve feet high, and perfectly smooth, so that a snake could not climb up. In the center of the pit there was a large block of rough masonry, perforated so that it was as full of holes as a sponge. In this honeycombed block the snakes dwelt; and when the sun shone brightly they came out to bask or to feed. His majesty used to have live frogs put into the pit, and amused himself by seeing the hungry snakes catch the frogs. When a large snake catches a small frog, it is all over in an instant; but if a smallish snake catches a largish frog, so that he can not swallow it at once, the frog's cries are piteous to hear. Again and again I have heard them while out shooting, and have gone to the bush or tuft of grass from which the piercing cries came—sometimes in time, sometimes too late to save poor froggy, though the snake generally got shot. As a final story let me tell how a frog has been seen to turn the tables on the snake. Two gentlemen in Cachar some years ago saw a small snake seize a small frog and attempt to swallow it. But suddenly a large frog jumped forward, seized the snake's tail, and began to swallow the snake. How the affair might have ended can not be told, because my friends imprudently drew near to watch the combat, when the frogs and the snake took alarm, and the big frog disgorged the snake's tail, and the snake released the little frog, and they all scuttled off. But the tale is perfectly true, and both the gentlemen who saw it are still alive; and I only regret that it was not my good luck to see the affair with my own eyes.—*Longman's Magazine.*

## AINU HOUSES AND THEIR FURNISHING.

By J. K. GOODRICH.

ON approaching an Ainu village one is deceived as to the number of houses, and apt to underestimate them. I fancy this is because of their being scattered about most irregularly, and because there are no streets to guide the eye. Along the coast the villages are, as a rule, built just inside of the first row of sand-dunes, which afford considerable protection from the heavy gales. Since the Japanese Government has undertaken the management and development of the Hokkaido, a good road leads through each village; but off on either side of this road the houses are built according to the fancy of the various occupants, and if a stranger

visits the village in summer, many of the outlying huts will be hidden among the tall, rank weeds, and by the growing vegetables. In every village which I visited I was constantly being surprised at the guides taking me off by some narrow foot-path in a direction where I had not suspected there was a house, and always we would find one or more.

The Ainu huts possess no claims to consideration from an architect. Their light frames have just strength enough to carry the thatch and resist the ordinary winds that blow from the ocean, on the shore of which most of the Ainu villages are built. We will consider a large house in which will be domiciled a family consisting of father, mother, and several well-grown sons and daughters. In building such a habitation the quadrilateral roof is first made. The ridge-pole and plates will probably be roughly hewed sticks of considerable size, in one piece if possible, though jointed if necessary. The girders and rafters are round sticks, lashed together and to the ridge-pole and plates with withes. No nails or tree-nails are used. Strong tie-beams support the plates, and when the roof is raised to its place, will carry shelves for stores, clothing, implements, etc. The thatch of the roof is laid on in courses of about eighteen inches in length, conforming to the length of the tall reeds and *arundinaria* of which it is made.

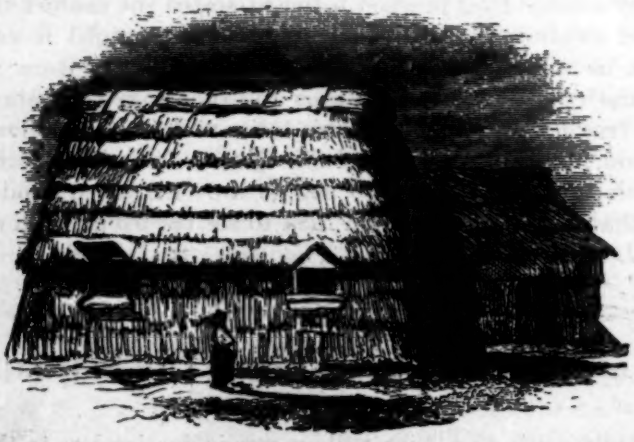

FIG. 1.—AINU HOUSES.*

The ridge is usually thicker and stronger than the rest of the roof, and is lashed by seizings at short intervals; the ends of the ridge-pole often project slightly, and small openings are left at either end under the ridge, which serve as smoke-holes. The roof is closely laid, turns water well, and has sufficient pitch to cause the melted snow to run off freely. Its strength is quite remarkable,

* For the illustrations in this article we are indebted to "Unbeaten Tracks in Japan," by Isabella L. Bird.—EDITOR.

as the weight of snow, which often lies three and four feet deep, is considerable; while the force of the ocean-gales which speed in from the Pacific must subject it to very heavy strain. The eaves reach to within about four feet of the ground.

When the roof is quite finished it is raised by main strength and stupidity, and the corner posts, which are substantial sticks roughly squared, are placed in position. Then the wall-frames of smaller sticks, oftentimes with the bark left on, are lashed to the plates and to cross-pieces, to which are fastened the rushes of the wall. These are not laid on in a heavy thatch, as they are on the roof, but in one or two flat courses; very often they are so thin in places that it is possible to see between them. The median line of the house is always in an east and west direction. A sacred window is left in the middle of the eastern wall, through which the sun-god is worshiped, and before this an *inao* is placed. Another window, perhaps two, will be cut in the south wall just under the eaves. All the windows are closed by shutters opening outward and swinging from the top, being caught up and held by a lanyard secured to the eaves on the outside.

In the house which we are describing there will be an addition on the west of about fifteen feet square, but much lower than the main building. The roof of this is also made first, raised to its proper position, and the thatch joined to that of the main house. This roof slopes toward the north, west, and south. The walls are the same as those of the main building, the entrance-door being in the southern wall and protected by a small porch with thatch roof and rush walls; opposite the entrance-door a small window is cut in the north wall, and beneath it is placed a rude sink for culinary purposes. As the occupations of the inmates do not require much light, the windows are quite sufficient, while ample ventilation is secured through them and the thin walls. There are no partitions inside the hut, though the western extension is sometimes separated from the main room by a light wicker framework, about three feet high, with openings at the sides of the fireplace, which is always directly under the ridge-pole, but rather nearer the western end. The fireplace is oblong in shape, the ashes being kept at about the level of the floor on either side. Sometimes the whole floor of the main apartment is boarded over on the north, east, and south sides of the fireplace, but usually this flooring only extends along the eastern end under the sacred window, the entrance-door always being in the western end of the single building, or in the southern wall of the western extension. The northern side of the fireplace is sacred to the family, a small sleeping-box being usually built under the eaves; the head of the house, or eastern end, is reserved for permanent or distinguished visitors, and the southern side is for occasional callers.

With the house built and the family in possession, let us enter and see how they conduct themselves, and how they arrange their various goods and belongings. And, in order to make the picture more real, I will describe some houses which I actually visited in the village of Horobetsu, province of Iburi, on the east coast of the island of Yezo. Passing through the porch of the first house into the western extension or vestibule, we found a medley of articles hanging from the beams and pegs in the walls or resting on shelves hanging from the cross-beams, or tossed into the corners and lying on the earthen floor. There were pack-saddles, bundles of grain and hemp, some strips of smoked fish, clothing (old and new), fishing and hunting implements, and apparently a thousand and one useful and useless things scattered about in the wildest confusion. This room was evidently the workshop, and two old women were busily occupied, nor did our entrance in the least disconcert them; for, after giving us a pleasant greeting and a laughing permission to examine everything, and to write and sketch as much as we pleased, they went on with their work—nor did they stop from time to time to see what we were about and to talk about the foreigner, as I am sure Japanese peasant-women would have done under similar circumstances. One of those women was cutting off the heads of a lot of barley with an old knife, preparatory to thrashing, and preserving the straw for future use in making rough mats; the other was washing a lot of potatoes that had evidently been torn from the earth all too soon, or else they were of the kind known as "small potatoes and few in the hill." This one had apparently left her weaving to care for the potatoes, as a mat-loom was lying on the ground near her.

Between this vestibule and the main room the wall had been cut away (probably had never been built), and a light, open wicket fence made of rushes, about three feet high, thrown across the dividing line, with openings on the north and south sides giving entrance to the living-room. Passing through the southern entrance we found that the fireplace was surrounded on the west, north, and south sides by a narrow passage-way, the floor of which was the ground itself. This was backed up by a narrow shelf on the north and south, but on the east the raised dais came up flush with the rim of the fireplace.

The south side of the house is devoted to the younger members of the family and to occasional visitors. Close to the wall were some small boxes containing the private belongings of some of the girls. Strange to say, these boxes, although without locks or fastenings of any kind, are considered inviolable by the men, and no one ventures to open them save the owner. Even if the master himself knows that they contain the much-coveted *saké*, to

get which an Ainu man will resort to any expedient, or contain ready money with which he might purchase the one thing essential to perfect happiness according to his light, he does not dare to violate their sanctity.

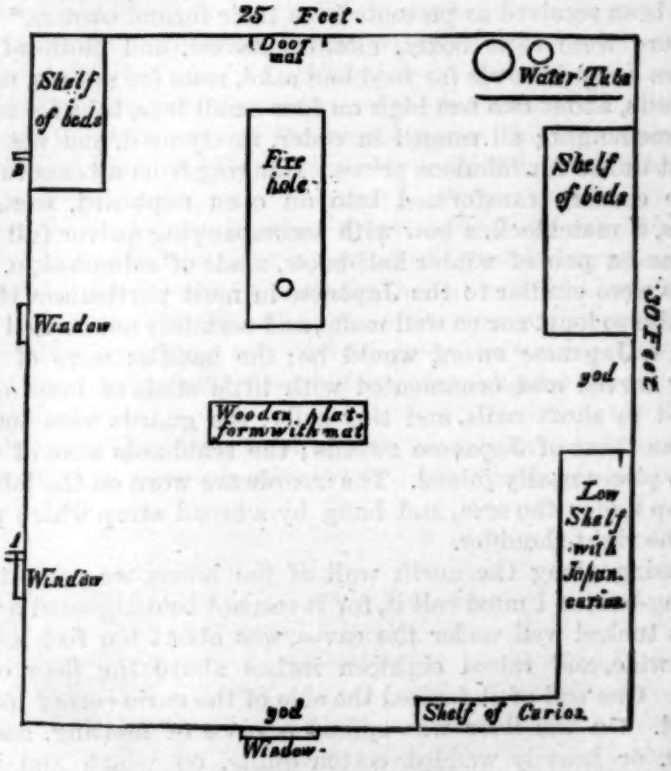


FIG. 2.—PLAN OF AN AINU HOUSE.

Back of the eastern dais, along the wall under the sacred window, were hung some very pretty mats with a curious, semi-geometrical pattern picked out in brown and red. These served as a background for one or two sets of open shelves, on which were arranged a number of cups, plates, and other pieces of crockery for every-day use. These were all of Japanese manufacture, and had evidently been brought from the main island, for the Ainu do not make pottery of any kind; nor is there any authentic record of their ever having done so, though they have a myth that in ancient times they possessed the art, but that all specimens were destroyed, and the written instructions for making ware were stolen from them. It may be remarked, parenthetically, that this is entirely discredited by those who know most about Ainu ethnology.

In the northeastern corner of the house—which, next to the eastern window, is held sacred—on shelves, some of them covered

with mats, were a number of Japanese household utensils in lacquer, carved wood, earthenware, and brass. Many of these were very old and excellent specimens of art, and some bore the crests of Daimiyo (feudal lords of Japan), showing that they had very likely been received as presents from their former owners.*

There were food-boxes, clothing-boxes, and clothes-frames (clothes-horses), bowls for food and saké, rests for swords, urns or tea-chests, about two feet high on four small legs, tubs for saké of the same height; all ranged in order, rarely used, and not to be bought unless for fabulous prices. Hanging from a beam in front of the corner, transformed into an open cupboard, were four swords, a matchlock, a bow with accompanying quiver full of arrows, and a pair of winter half-boots, made of salmon-skin. The swords were similar to the Japanese in most particulars, though not quite so long, nor so well made, and certainly not as well cared for as a Japanese sword would be; the handles were of wood, rudely carved and ornamented with little studs of brass or tin, secured by short nails, and tiny bells; the guards were just the same as those of Japanese swords; the scabbards were of wood, in two pieces neatly joined. The swords are worn on the left side, well up under the arm, and hang by a broad strap which passes over the right shoulder.

Passing along the north wall of the house, we came to the sleeping-box, as I must call it, for it can not be designated a room. It was tucked well under the eaves, was about ten feet long by eight wide, and raised eighteen inches above the floor of the house. One end of it formed the side of the curio corner just described. On the floor was spread a piece of matting, and the *futons*, or heavily wadded cotton quilts, on which and under which the family sleep at night, were neatly folded and laid in a pile on one side; the pillows in this house were of the Japanese pattern, little stands that support the neck, and which look to be wretchedly uncomfortable, but which are not so very bad when one gets accustomed to them. At night, or whenever any one is sleeping, a mat curtain is hung up in front of the sleeping-quarters, thus sealing up the inmates almost hermetically. I can not imagine any greater misery than to be compelled to be one of

* Miss Bird says: "Some of these things were doubtless gifts to their fathers when they went to pay tribute to the representative of the Shôgun and the Prince of Matsumae, soon after the conquest of Yezo. Others were probably gifts of *samurai*, who took refuge here during the rebellion, and some must have been obtained by barter. They are the one possession which they will not barter for saké, and are only parted with in payment of fines at the command of a chief, or as the dower of a girl." At the close of the rebellion of 1868, one last stand was made by the Tokugawa adherents in Yezo. The Ainu were non-combatants, and doubtless had many opportunities of befriending the unfortunate ones, who showed their appreciation of Ainu kindness and hospitality by leaving some of their belongings.

half a dozen to occupy that miserable little box at night, deprived of all fresh air save the little that might strain through the reeds of the house wall, for "freshness" can not be applied to the air from the interior of the house itself, that must reek with the stench of rancid oil, half-cured fish, smoke, etc., and, as for fleas and insects not usually mentioned in polite society, let us draw the curtain!

We have now passed quite round the hut and reached the entrance on the north side of the wicket fence. In this corner were the spare clothes, rough-weather garments, and private boxes of the master and mistress.

An iron kettle was hanging from a crane over the fireplace, and strips of sword-fish and salmon-flesh were curing on a frame suspended over the fire, the smoke being increased by burning green wood and leaves. The effect of this pungent, stinging smoke was very trying to eyes and lungs, and compelled me to cut my visit and minute description rather shorter than I would have wished.

Various fishing and hunting implements and miscellaneous odds and ends were placed on the cross-beams, or on shelves

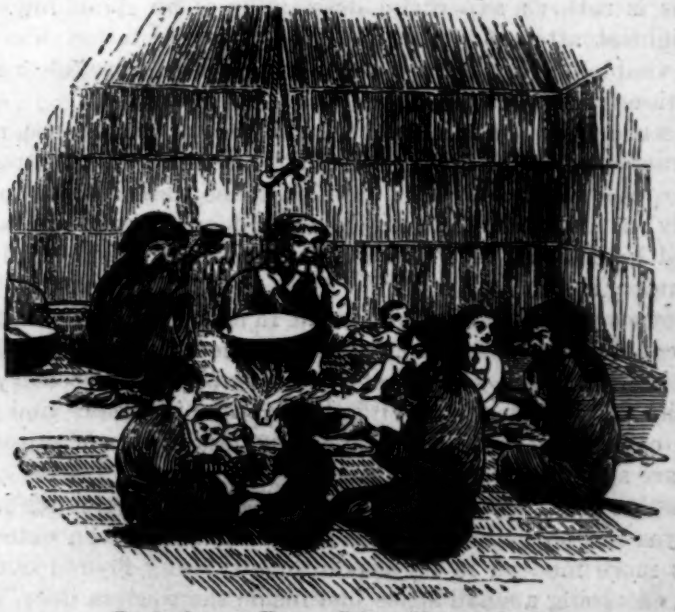

FIG. 8.—AINU AT HOME. (From a Japanese sketch.)

resting upon them, just as will be seen in farmers' and peasants' houses the world over. Though hunting and fishing are essentially the occupations of the men, and the women's assistance is only called in to perform the drudgery of cleaning, salting, and curing the fish and dressing and cooking the bear's meat, still the women

are tacitly permitted to go fishing by themselves on moonlight nights, when they use the spear and nets almost as dexterously as the men.

There was no ceiling of any kind, and the inner side of the thatch, the beams, girders, etc., were black with smoke and glistening with oil and grease. When foreign guests remain overnight, a temporary room is set off for them at the eastern end by spreading a mat over the beams and hanging others therefrom.

There was nothing resembling a chair in the remotest degree; the men sit in true Turkish fashion, and the women either rest in that way or squat upon their heels like the Japanese. The nearest approach to a table was the small *zen* upon which the dishes of food are placed, an independent zen for each person, but these are not often used by the Ainu. At meals each person's bowl is filled from the pot by the mistress and handed to him, and, as their dishes are generally stews containing a little of everything in one grand mess, a series of bowls or dishes for a variety of courses is not necessary. Of wall ornaments, such as pictures and *kakemono* (the favorite hanging scroll picture of the Japanese), there was nothing at all.

This is rather a superficial description of an Ainu hut. Not the slightest attempt at architectural ornamentation was anywhere visible, the single idea seemingly being to provide a slight protection from the worst of the weather.

At a short distance from each hut is a small storehouse, raised on a framework about five feet from the ground. In construction this is quite the same as the house itself, the walls sloping inward slightly for the sake of strength. The door is at one end, and is reached by a ladder or a notched stick. It was a delightful comment upon the character of the Ainu to note that none of these storehouses were locked or fastened in any way against thieves. They contain the spare food, the unthrashed grain, etc. I should think, however, that some sort of locks would be necessary now that the population of the villages is becoming more and more mixed each year, for the average Japanese's ideas of *meum* and *tuum* are apt to be somewhat vague.

Another hut which I visited, and where I made a much longer stay, was not so large as the first, having no western extension. It was more modern in its appointments, being floored over entirely, excepting a small space just inside the western door, where visitors put off their sandals or shoes. We were fortunate in finding some men here, and the master took great pride and apparently much pleasure in displaying his treasures, but he refused to be at all communicative as to their history. He, too, possessed many choice bits of old lacquer, and many Japanese curios, which he said had been given to his ancestors. More than that he would

not say, and I finally concluded that he could not. All of the men and some of the women wore large brass ear-rings. There was one woman with a roguish, gypsy face, that strongly confirmed Miss Bird's comparison of these people to the inhabitants of southern Spain. Her peculiarity of speech in the matter of final *a* and *e* was so marked as to induce a smile, and, as soon as she detected it, she was so much disconcerted that she would say

FIG. 4.—AINU STOREHOUSE.

nothing more. I was sorry for this, as her voice was truly musical, and I know she was sorry also, because, being the mistress of the house, she was itching to have a word in the bargaining that ensued. This house was comparatively clean, and, when mats had been spread for us at the eastern end, we were quite contented to remain for a long time.

At first, the master of the house pretended to be very reluctant to sell any of his possessions, but, after much persuasion, he at last consented to let us have a sword, a bow and arrows, and a lot of small things which we still keep as souvenirs. Then, when the others found that trading *for money* had commenced, they went off for things, and soon we were overwhelmed with bargains. Evidently the Ainu have advanced in foreign civilization, in one respect at any rate; for, instead of evincing any disinclination to take money for the articles we wanted, they at first asked exorbitant prices, over which we did considerable haggling before agree-

ing upon a sum that was very high for them, but fairly reasonable for us.

In a third house half a dozen women were cutting up swordfish and preparing strips for smoking, by stretching them with pieces of stick into a regular V-diamond pattern. Several men sat round smoking and giving orders, but loftily refusing to do anything to assist their wives. The men apologized for the dirty appearance of the place, and truly an apology was in order, for a dirtier, more malodorous house I never entered! They said we would not care to sit down, nor did we. A hasty glance was enough to show us that, in all essentials, this was quite similar to the others.

I paid a visit to the village chief, who lives in a large house, a part of which is occupied by a Japanese Christian, who is trying to do missionary work among the people. The chief, a very old man, received me sitting in front of his cabinet of Japanese curios. He bowed, extended both his hands with the palms up, waved them toward himself, and stroked his long gray beard. These actions were repeated twice, and were accompanied by a low, murmured greeting, which was translated to me as meaning that he deemed himself highly honored by my call, and hoped I would enjoy myself during my stay in his village. The Ainu, he said, were too poor and too ignorant of the manners of honorable foreigners to do anything to entertain me; and a lot of compliments and pleasant things. His quiet dignity of manner, and his low, musical voice impressed me very favorably; and, although he was dirty and clad in rags, he looked the chief.

FIG. 5.—AINU PATRIARCH.

One of my guides brought something in his hand and asked, in rather a mysterious way, if I wished to see an Ainu musical

instrument. Of course I said that I did, when, to my great astonishment, he produced an iron Jew's-harp of orthodox pattern, and to my utter astonishment told me that it was an original Ainu invention! Aside from the fact that it evinced a degree of skill in metal-working to which the Ainu have never attained, its whole appearance betrayed it at once. It is true that they have a musical instrument, of which Miss Bird writes: "They have another which is believed to be peculiar to themselves, consisting of a thin piece of wood, about five inches long and two and a half inches broad, with a pointed wooden tongue, about two lines in breadth and sixteen in length, fixed in the middle, and grooved on three sides. The wood is held before the mouth, and the tongue is set in motion by the vibration of the breath in singing. Its sound, though less penetrating, is as discordant as that of a Jew's-harp, which it somewhat resembles." I did not see one of these wooden instruments, but that which they showed me was so unmistakably of foreign manufacture that I could not suppress a smile when the extraordinary claim was made, and thereby hurt the feelings of the sensitive Ainu. This claiming priority in inventing the Jew's-harp quite jumps with their assertion that their progenitors used tobacco (though the dates of the introduction of tobacco to China and thence to Japan are quite well known, and it is beyond question that the Ainu learned of tobacco *and how to use it* from the Japanese); that they used to have a written literature, all traces of which were stolen by Yoshitsune; and other minor but equally untenable claims.

The only Ainu weapons which show any individuality are the bows and arrows. Their knives, swords, spears, and matchlocks are clearly of Japanese make. They have discarded flint and stone arrow-heads and spear-points, but only a comparatively short time ago; specimens in obsidian, etc., can be dug up in the vicinity of most of their villages.

The Ainu bow is made of a light, rather coarse-grained wood, resembling red cedar in appearance. This wood is called *on-ko*; in Japanese, probably, *araragi*, (*Taxus cuspidata*); the Chinese character which the Japanese employ for this wood seems to refer to the *Ailanthus glandulosa* by the synonyms, but may also denote a kind of *Rhus* (*Rhus cotinus*). Batchelor says that the *on-ko* is the yew-tree. It is very inelastic, and, unless a singularly good piece can be obtained, the bow is wrapped with thin strips of wild cherry to increase its elasticity—just as the Esquimaux seize their bows and brace them with intestines. I examined a great many bows, but did not see any "stout saplings with the bark on," as mentioned by Miss Bird, and I am inclined to think that she may have mistaken the cherry-seizing for bark. The bows are short, the longest I saw being only fifty-three inches, the

shortest not over thirty-six inches. They are all roughly dressed to a round shape, and are quite devoid of ornamentation.

Miss Bird's description of their poison-arrows is so exact that I take the liberty of transcribing it entire: "The arrows are very peculiar, and are made in three pieces, the point consisting of a sharpened piece of bone with an elongated cavity on one side for the reception of the poison. The point or head is very slightly fastened by a lashing of bark to a fusiform piece of bone about four inches long, which is in turn lashed to a [reed] shaft about fourteen inches long, the other end of which is sometimes [usually] equipped with a triple feather, and sometimes is not. The poison is placed in the enlongated cavity in the head in a very soft state, and hardens afterward. In some of the arrow-heads, fully half a teaspoonful of the paste is inserted. From the nature of the very slight lashings which attach the arrow-head to the shaft, it constantly remains fixed in the slight wound that it makes, while the shaft falls off."

The exact composition of this poison is not known, I believe, but aconite (*Aconitum Japonicum*, a monkshood) is doubtless the principal ingredient. The Ainu claim, that a single wound kills a bear in ten minutes, seems to be well grounded, although few foreigners have ever accompanied them on their bear-hunts. They allege that the flesh is not rendered unfit for eating, though they take the precaution of cutting away a considerable quantity of it round the wound as soon as they can get at the bear.

In using the bow, it is held upright, grasped near the middle by the left hand, and held as nearly as possible at arm's length. The string and nock of the arrow are caught between the thumb and first inner joint of the forefinger of the right hand. The arrow is passed on the *right-hand* side of the bow and between the first and second fingers of the left hand. The pull is made toward the right ear, as in Western archery, but, owing to the stiffness of the bow and the shortness of the arrow, it is not a very long pull. That is not necessary, however, for the bow is only used at close quarters, when the aim need not be very accurate. The string was formerly made of attush, but they now use hemp or hard-twisted cotton.

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ATTENTION is now directed to the provision for recreation and exercise in girls' schools. While a great improvement has been realized in the matter, it is still in most schools quite insufficient. The usual provision for calisthenics, light games, and geological and botanical walks, is only held to be good as far as it goes. It can not pretend to contribute to the making of sound women in the sense in which the perfect freedom of activity given to boys tends to make them sound men. Perhaps notions of the degree of physical freedom it is proper to allow girls at school are at fault.

# TEACHING PHYSIOLOGY IN THE PUBLIC SCHOOLS.

By A TEACHER.

IT will not be amiss at this time, when many of the States have decided that "physiology and hygiene, with special reference to the effects on the human system of alcoholic stimulants and narcotics," must be taught in their public schools, to glance at the reasons for such teaching, at some of the books and methods in use, at some of the results already obtained, and at what might reasonably be expected to result from proper teaching and proper study.

Those who study the causes of infant mortality, especially in large cities, of intemperance among the laboring-classes, of the crimes which thrive in the hot-bed of tenement-house life, of the increase of nervous disorders and insanity in this country, can not but see that dissipation (using the term in a general sense) and a disregard of the requirements of health are responsible in a large measure for the evils named, as well as for others which afflict mainly the so-called higher classes of society. The fact that much of the dissipation and the disregard of health laws is due to ignorance rather than to want of thought is sufficient reason for the study of health laws. But, as the health of individuals is closely related to the health of the village, town, or city in which they live, and as "public health is public wealth," another reason is apparent for the popular study of hygiene. Says Dr. H. P. Yeomans, of the Provincial Board of Health, Ontario, Canada: "Practical experience has demonstrated that the work of educating the people in all that pertains to public hygiene is a most important factor in the successful accomplishment of our objects as sanitarians. At every step in our legislative halls with local health authorities, in communities, and in our experience with individual citizens, we encounter more or less opposition arising from a lack of intelligent comprehension of the causes of disease, the best method of preventing the spread of epidemics, and generally of the preservation of public health. . . . It is a well-recognized principle, especially in a free country, where the sovereign power is lodged in the body of the people, that popular sentiment must proceed in advance of legislation in order that the successful enforcement of law may be secured."

The instruction of the adult population in health matters must be, in the main, through the current literature of the day and by popular lectures. The children who are to be the future molders of the country's welfare should be systematically and properly taught in the schools physiology and hygiene, with only enough anatomy as a foundation for the study of physiology.

If Dr. Hammond's statement be correct that many school children of the present day are oppressed mentally and physically by too many and too hard studies, it is imperative that parents, teachers, and even pupils should know what work the child's brain and body can and ought to bear. But this statement of Dr. Hammond will cause the introduction of the studies of physiology and hygiene to be objected to by some on the ground that any additional studies will weigh too heavily upon the children. This objection is a valid one if the prescribed lessons are to be merely memorized by pupils, and if the children are to be rigorously marked for not remembering. Improperly taught, as these subjects too frequently are, they become distasteful to the pupil, discouraging to the teacher, and are calculated to do more harm than good. Properly taught, they will not be merely additional studies for the pupil to grind out with tears and labor and vexation of spirit, but will be welcomed because they lighten the work imposed by the routine of school-life.

Until very recently, in order to obey the precept, "Know thyself," the teaching has been almost altogether anatomical, dry descriptions of the position, shape, and use of bones, muscles, and the various tissues of the body. Unfortunately, much of this sort of teaching still prevails, even for young children, and some of the books in use foster such teaching. Fortunately, many of the books devote more space to physiology than to anatomy, but a few only give much attention to hygiene, which is the most practical of the three studies, but its study should be associated with that of the other two.

Says Dr. Parkes, the eminent sanitarian: "Hygiene aims at rendering growth more perfect, decay less rapid, life more vigorous, and death more remote." Information that will help to effect these ends is what is needed by all who wish to enjoy and accomplish most during life. While it is of interest to know what bones are, and how many there are in the body, where the location of the heart is, and what are its functions, it is of more practical importance for all of us to know what will keep the bones in sound condition, and what we should or should not do in order that our hearts may serve us faithfully many years. The practice of hygienic laws, as well as the study of hygiene, is needed both in and out of schools much more than mere anatomical and physiological knowledge. Dr. Stephen Smith, as President of the American Public Health Association, voiced the opinion of many sanitarians when, in 1873, in an address before the association, he said: "Were a well-digested system of education in hygienic matters, which so vitally concern the well-being of every person, adopted and put in practice with anything like the vigor with which we insist upon the study of the common and useful branches, like

geography, arithmetic, and grammar, and the uncommon or ornamental branches, as French, music, etc., within one generation the whole mass of the people would be so enlightened on subjects relating to the hygiene of every-day life that our average longevity would be immeasurably increased." Not only would life be prolonged, but better mental and physical work would be accomplished by the prevalence of health, which to many a worker is more than half the battle, and the poor quality of which holds many an earnest soul down in the toils of poverty and despair.

Since Dr. Smith's address was delivered, efforts have been made to systematically teach in the schools the principles of physiology and hygiene, but the results have not been as good as we had a right to expect. This has been owing to the character of many of the text-books in use, to the short time allotted to the study of physiology and hygiene in the schools, to the unsatisfactory education of the teachers in hygienic matters, to the undue teaching of anatomical details and the use of hard technical terms, and, finally, to the preponderance of so-called temperance teaching to the exclusion of other and weightier matters.

We can not coincide with the view of the distinguished editor of the "Sanitarian," as set forth in an editorial, June, 1877, that "with such a multiplicity of studies the teacher *never* (italics ours) goes beyond the text-book." But we do agree as to much that follows. He says: "The pupil learns that muscles are not bones, that the liver is a gland, and that the heart is a muscular organ, that the food in some way or other is turned into blood. Beyond this there lies a nebulous mass of learned names, barbarously pronounced and ignorantly applied, which the first contact with the world dissipates, as a summer sun does the mist of the morning. . . . The text-books . . . are mere table-books and catalogues of names, or else their familiar style is so gelatinous that the student is unconscious of swallowing anything. One author treats the subject from a chemical standpoint, another from an anatomical standpoint, while the third combines the two with an unprofitable result."

The following extracts from some of the books now in use in the schools indicate how anatomy, physiology, and hygiene are being taught in certain quarters, for there are many teachers who *will not* know anything in regard to any subject outside of the text-book used by them:

One book says in its preface: "Technical terms have been avoided, and only such facts of physiology developed as are necessary to the treatment of the effects of alcohol, tobacco, opium, and other truths of hygiene." A careful perusal of this book will show that the physiological facts developed have little or nothing to do with the *treatment* of the effects of alcohol, tobacco, etc.

Much is said in the book as to what the effects are, but nothing as to the treatment of these effects. And why should there be? Such information should be confined to medical works. On one of the pages of this book is the following: "Children's bones have more gristle than those of older people; so children's bones bend easily. I know a lady who has one leg shorter than the other. This makes her lame, and she has to wear a boot with iron supports three or four inches high in order to walk at all. One day she told me how she became lame. 'I remember,' she said, 'when I was between three and four years old, sitting one day in my high-chair at the table, and twisting one foot under the little step of the chair. The next morning I felt lame, but nobody could tell what was the matter. At last the doctors found out that the trouble all came from that twist. It had gone too far to be cured.'"

The writer of this account would have the reader believe that the hip-joint disease which the lady had, and which caused the shortening of three or four inches in one leg, resulted because there is more gristle in the bones of children than in those of adults, and because on *one* occasion a child between the ages of three and four years twisted its foot under the little step of a high-chair. This twisting, it is presumed, injured the gristle somewhere in the leg, and so caused deformity. How many little children are there who do not twist their feet under the little steps, as they sit in their high-chairs? In how few does hip-joint disease result. If a child runs the risk of such an affliction every time the foot is twisted under the little step, then the children of nowadays are puny folk. The truth is, such a result is rare, if it ever happens with a healthy child. Still, if a child can be taught to sit straight in its chair, with feet on a level and side by side, well and good. Most physicians, I take it, would be apt to say in regard to this reported case of deformity: "If such a result followed such a twisting, in all probability the child was not strong and healthy, but of a rachitic or rickety tendency. In such children the bones and ligaments are *unusually* soft and quite easily bend out of shape."

On another page of this book is a pretty picture of a mill, which the text tells us is a snuff-mill. The writer says that after entering the mill "the smell of the tobacco was so strong that I had to go to the door many times for a breath of pure air. I asked the man if it did not make him sick to work there. He said: 'It made me very sick for the first few weeks. Then I began to get used to it, and now I don't mind it.'" Then the writer adds: "He was like the boys who try to learn to smoke. It almost always make them sick at first; but they think it will be manly to keep on. At last they get used to it." Who will say that the

average boy will not try to get used to tobacco after being told that he can do so if he will?

The book dwells, wherever there is a chance, upon the evils of alcoholic drinks, but gives, in all earnest, the following bill of fare as suitable for the dinner of a child: "Roast beef, potatoes, squash, bread, butter, salt, water, peaches, bananas, oranges, grapes," but no where is there any advice as to how much of these things should be eaten at one meal. Intemperate *eating* is considered a matter of small account.

In one place is the following saying: "A good cook has more to do with the health of the family than a good doctor." It might, perhaps, have been well for the writer to quote this saying if it said, "poor doctor" or "many a doctor." A good cook is surely a blessing, but there are good cooks and good cooks as the opinions of different families go, and, while food that has been cooked by a "good" cook may taste well, it may not digest well. Good doctors at the present time not only know what good cooking is, but are able to choose digestible food as well. The above motto is a fair specimen of the sayings which are recklessly put into text-books.

A second book in use states in its preface as one of the reasons why the book should appeal to teachers, "The adaptation of the text to oral instruction, *the teacher's work being already arranged.*" The italics were used to emphasize the fact that the teacher's work has been made easy, and that no particular effort on his or her part will be necessary. This book, with about two hundred and twenty-five pages of text, devotes thirty-seven pages to bones, giving numbers and names in detail, while three and a half pages only are devoted to the subject of food, and twelve to digestion. The front and rear views of the normal skeleton depicted in the book are pictures of deformed skeletons, with lateral curvature of the spine and ill-shaped skulls. An accurate picture for a school-book is evidently not a matter of importance.

This book has pictured, as do other text-books, to magnify the evils of tight-lacing, the skeleton of a well-formed chest with an outline of the body and the skeleton of a contracted (corset-laced) chest with no such outline. The outline in the one case gives the appearance of much expansion, and the absence of it in the other exaggerates the contraction. This method of representation is considered by reliable artists as tricky, and was pointed out to me by an excellent lady teacher of physiology and hygiene, as an unfair way of showing the evil effects of tight-lacing.

A third book, intended for the use of primary schools, is made up of questions and answers; nothing left for the teacher to evolve, nothing for the pupil to imagine or solve. Both teacher and pupil are machines to grind out so much material in an al-

lotted time. Five or more pages of this small book are devoted to bones, especially the location and number, but nothing is said as to what is necessary to keep bones in good condition.

The subject of alcohol is fully treated of, but intemperate eating, exercise, sleep, bathing, etc., are not even referred to. We doubt whether pupils who use this book could answer correctly if questions upon the various subjects were put to them in a different way from those they have been accustomed to.

A fourth book endeavors to teach the truths of anatomy, physiology, and hygiene in an allegory. The preface presumptuously compares the allegorical teaching of the book with the parables of Christ, and says: "If the great truths of Christianity could be taught in allegory, may not less difficult subjects in the same manner be made interesting and instructive." The preface further states that the authors have "shun abstruse and technical phraseology," have aimed "to give correct and scientific views in simple language with correct illustrations."

On looking over this book, we notice many poor pictures and the fact that a number of the pictures, though lettered, have nothing about them to indicate what the letters stand for. It is noticeable, also, that technical and abstruse terms are not infrequent, such, for example, as "perimysium," "quadrangular papillary clumps," "sebiparous glands," "germs of absorbent vesicles," etc. A third feature of this book are the attempts to be facetious. For the most part these attempts are ridiculous and out of place in a school text-book.

A fifth book, which has a large sale and is in the main excellent, has at times evidences of careless teaching; for example, "When milk produces an unpleasant effect upon the stomach, it should be mixed with a *little* lime-water." Italics are ours. In the list of antidotes for poison from fish-eating, appears the following: "Ether with a *few* drops of laudanum mixed with sugar and water may afterward be taken freely." Again italics are ours. In the use of mustard as an emetic not a word is said as to the importance of mixing it thoroughly with the water used, lest suspended in mass it may inflame or irritate the stomach.

We may judge somewhat of how a study is in general taught by the oral or written answers given by a number of pupils, in various schools, in reply to questions upon the study. About a year ago there appeared in the London "Architect" the following: "If instruction in sanitary matters is to be continued in schools it will be necessary to supplement the lessons with visits to some such place as the Parkes Museum of Hygiene, unless the school boards are satisfied if the children get hold of a lot of hard words, or rather of sounds resembling them. At present it is supposed that sanitary science may be taught as easily as morality,

by listening to a teacher read from a book. The children fail to catch the words, or they attach no meaning to them. Here, for example, are verbatim copies of the exercises in one of the Greenwich schools:

"'Infections are brought on by bad smells, such as small-pox, measles, scarlet-fever, glass-pox, s. c., they are brought on by bad drainerges suers; they must be well ventalated. Infection disease are caught by touching such as charcoal, chloride of lime, etc. Measles, feaver are called disinfectionous because they are catching.—Fainted. If a person as fainted, take her out in the open air lay her down with her head. And do the clothing round the neck and dashed cold water the face and hand and put smelling salts to her nose. Degestion is paines in the head, paines in the stom-ach, bad tempers. From degestion comes consumption, information, head-ache, neuralgia.'

"These exercises may be thought amusing, but it should be borne in mind that every word represents more or less pain to some unhappy child, in endeavoring to recall ponderous words which were without meaning. Education in sanitary matters is desirable, but, as it is conducted at present in public schools, it must injure children's minds by habituating them to the use of words which they can not understand."

In the English official reports we read that "an examination of girls in board schools for prizes offered by the National Health Society, revealed some curious items of information. One reply to Mention any occupation considered injurious to health' was, 'Occupations which are injurious are carbolic acid gas, which is impure blood.' Another pupil said, 'A stone mason's work is injurious, because when he is chipping he breathes in all the chips, and then they are taken into the lungs.' A third says, 'A boot-maker's trade is very injurious, because the boot-makers press the boots against the thorax; and therefore it presses the thorax in, and it touches the heart; and if they do not die they are cripples for life.' With a beautiful decisiveness, one girl declares that 'all mechanical work is injurious to health.' A reply to a question about digestion runs, 'We should never eat fat because the food does not digest.' Another states that 'when food is swallowed it passes through the windpipe'; and that 'the chyle flows up the middle of the backbone and reaches the heart, where it meets the oxygen and is purified.' Another says, 'The work of the heart is to repair the different organs in about half a minute.' One little physiologist replies: 'We have an upper and a lower skin; the lower skin moves at its will, and the upper skin moves when we do.' One child ennumerates the organs of digestion as 'stomach utensils, liver, and spleen.'"

In the clever little book compiled by Miss Le Row, entitled

"English as She is Taught," appear the following genuine answers by pupils in reply to questions upon physiology and hygiene. Presumably most of these answers are from American pupils in American schools:

"Physillogigy is to study about your bones, stummick and vertebry." "When you have an illness it makes your health bad as well as having a disease." "The body is mostly composed of water and about one half is avaricious tissue." "The body has an infinite number of bones joined together by the joints." "The spinal column is made of bones running all over the body." "Digestion belongs to the lower animals." "Digestion is the circulation of blood." "Digestion is reducing our food to plump." "Digestion is when food is taken into the stomach." "The gastric juice keeps the bones from creaking." "The eyes are set in two sockets in a bone which turns up at the end and then becomes the nose." "The three coverings of the brain are the diameter, the perimeter and the trachea." "The growth of a tooth begins in the back of the mouth and extends to the stomach."

As an additional contribution to answers, we add the following, taken by the writer from the note-books of pupils of one of the *high-schools* of this country:

"Anatomy is dissecting of bodies generally lifeless." "Anatomy is study of parts of the body, physiology study of action of parts, hygiene is *application* of these parts" (italics are ours). "Kinds of bathing, adapted to the age, quantity, quality and health of the person." "Supernator are the muscles about the back." "The hygiene of a muscle should have proper rest and exercise." "Hygiene is the study of the time and manner of the action of the muscles and large blood-vessels." "The mouth is the commencement of the alimentary canal, and it extends through the throat, œsophagus into the stomach." "The extent of the mouth helps the digestion of food." "Nervous system a decided part of the body." "A young person who goes to parties and has great excitement has generally some brain trouble, such as St. Vitus dance." "It is far more reliable to drive out the fire of a room and put on extra clothing than it is to put on no clothing and sit in front of a burning fire." "Soap is important in carrying off the fat of the body." "What is eaten by the body has sometimes been taken as food." "The third cavity is the pelvis, which contains the vital organs." "In a diet of twenty-four hours a man should eat some of all the nutritious articles." "The first step in digestion is mastication and insalivation. Second, the muscles of the gullet." "A person is in fair health when he has the affinity to accommodate himself to change of climate and the ability to endure." "Respiration is the exchange of carbolic acid for oxygen." The substitution of carbolic for carbonic acid is fre-

quently met with. "The times for bathing depend on the age of, location of and heat of the individual."

The bad spelling so frequently found in these note-books shows, of course, ignorance or carelessness, either being reprehensible. Œsophagus is spelled "esofergus," "ecophagus," "sasofagus," "esolpusgult," "sarcophagus," "desophagus." The pancreas is spoken of as "the pangueous," or "the pantheis"; the parotid or salivary glands as the "perodic," "the galviatory and savilary glands," "the spiratory glands." The cerebrum is "the big brain, or celebra"; the cerebellum, "the little brain, or sedula." Suture-joints are "sucher-" joints. Hygiene is "hygine," or "hygene." Adipose is "adicose"; sweat is "swett"; osseous is "oscius"; cancellous tissue is "tenselous"; thoracic duct is "carasse duck," and so on.

Enough illustrations have now been given of the ignorance and carelessness of pupils in regard to anatomical, physiological, and hygienic knowledge to warrant us in saying, when taken in connection with the character of some of the text-books in use, that in many schools these subjects are improperly taught. But it will be said by some: "The fact that such and such text-books are unreliable in pictures and text does not prove that the teachers using them are guided by the unreliable material, and also the fact of faulty and absurd answers by pupils does not prove that these very pupils do not have a very fair general idea of the subjects they were questioned upon." Our answer is, that until teaching becomes, with the majority of female teachers especially, something more than a mere makeshift till marriage looms up, very many teachers will be guided solely and absolutely by the book they are using, and as long as favoritism and cupidity prevail in school-book committees, books will be adopted by school boards which are unreliable, mere compilations, written by persons who in some instances have confessed their incompetency as authors.

In regard to the second assertion, the answer is, after an experience of over twelve years as a teacher, and after conversation with many excellent educators and the examination of many hundred note-books, the number of pupils who have correct views as to the truths of physiology and hygiene is comparatively small. Ask some of the boy and girl graduates of your schools why it is that a certain amount of carbonic-acid gas in a well, cellar, or cave may be injurious to human beings in contact with it, and not injurious to persons in a room or hall, or which is the most nutritious food, or what produces and maintains the animal heat of the body, and notice how few give even reasonable answers. Yet a goodly number of these girls will be the future teachers. Listen to the curious and absurd statements of what

should and should not be used, eaten, worn, tasted, looked at, touched, etc., which are rehearsed by little children to their parents as coming from the primary teachers or the heads of primary departments, and then it will be perceived that the teaching of physiology and hygiene is not what we have a right to expect. What are the remedial measures?

1. Encourage the sale and use only of reliable text-books written by physicians or sanitarians who have had experience as teachers. The mere compiler will magnify the importance of what may be considered by comparison as the non-essentials, and will endeavor to perpetuate absurd and untruthful statements simply because they sound well.

2. Health boards, health societies, and sanitary associations have instructed by this time a goodly body of physicians in sanitary matters. These men and women may well be called upon to outline hygienic teaching, if not to be practical teachers themselves. In addition to instruction in normal and model schools by such special teachers, there should be a sanitary supervision of schools. The physicians appointed to do this work should look after the ventilation, lighting, and cleanliness of the school-buildings, the spread of contagious disease, the condition of wardrobes and closets, the vaccination of school-children, etc. In some cities the attempt is made to do this work through the health authorities, but it is unsatisfactory, as the physicians doing the work are, for the most part, political appointees, and not chosen for their knowledge of health matters. The work should be done by sanitary officers of boards of education. With proper teaching and proper sanitary supervision of the schools, hygienic subjects would be real to the pupil, and the value of hygienic knowledge would be so apparent that interest instead of apathy would be the rule. In 1873, at the annual meeting of the American Public Health Association, President White, of Cornell University, said: "First, as regards public schools, I would make provision for simple instruction in the elements of physiology and hygiene, either by the use of some short and plain text-book, or, what is still better, by lectures from some competent resident physician. I confess that I greatly prefer the latter method. Not only theory but experience leads me to prefer it. Were it not that we have made a great mistake in our systems of public instruction by severing our common-school instruction from advanced instruction, we should by this time have a body of teachers in our common schools abundantly able to lecture to the pupils without a text-book." It is now seventeen years since these words were uttered, and what do we find in regard to the teaching of physiology and hygiene? Just this, that the number of physicians who teach in the schools is very small, that the average teacher

of these subjects on duty has her teaching warped by her hobbies in regard to food, air, or some other hygienic measure, that she does not seem to be able to distinguish between essentials and non-essentials, and is carried away, it may be, by the dress or alcohol question. It has been found by experience that something else than the ability to lecture is necessary in order to get children to have correct ideas of the subjects taught. The daily drill, the "line upon line and precept upon precept," the bringing of the pupil up to the level of the teacher by the teacher's coming down to the level of the pupil, are all necessary. It is probably because these were deficient that we are able to record the answers to questions in the earlier part of this article. It is not a question of how much such and such a child ought to comprehend, but how much does the child understand.

All honor to the teachers who do make the subjects they teach understood as well as interesting.

3. What to teach. The teaching should be reliable, interesting, practical, in order "to inculcate sound national views regarding the necessity of obedience to laws of health, to secure willing obedience to the enforcement of sanitary law, to correct social and personal habits which are constantly operating as causes of disease." If the evils of alcoholic drinks are to be portrayed, as they undoubtedly should be, let the teacher show the relation between intemperance, crime, and immorality, and how intemperance results from imitation, habit, disease, and poverty, rather than spend her time in endeavoring to detail the dire effects of alcohol upon every tissue of the body, and to picture upon the child's mind what a drunkard's stomach looks like, or what a hob-nail liver is. Let her not forget to teach about intemperance in eating, exercise, bathing, study, etc., and to have an eye upon the evil effects of opium and cocaine intemperance, which are not uncommon. Let her encourage self-control, mental, emotional, sexual, physical. Have her dwell on the advantages of "lend a hand" societies, rather than on prohibition measures. The teacher can show how "health is wealth," what are the advantages of a healthy home and surroundings, how disease tendencies can be overcome, what "filth diseases" are and how they can be averted, how economical and nutritious food can be obtained and how prepared for eating. "In the personal habits of pupils, in the ventilating and heating of school-buildings, in the location of wells, in the character of the out-building, in the construction of school-houses and laying out of the grounds, in a proper observance of the purity or impurity of the water-supply, in the enforcement of laws for preventing the spread of contagious and infectious diseases, and in many other things practical truths may be instilled into the minds of pupils, and impressions made that will never be effaced in after

years." These are some of the subjects that should be taught, but in order to insure such teaching, the teachers, especially in the primary grades, should have some definite plan and instruction given them by competent and practical physicians. Were this done there would be less overloading of pupils with technical and unnecessary anatomical knowledge.

4. How to teach. Now that the study of psychology is fashionable we may hope, perhaps, for a better knowledge on the part of teachers of what is and is not necessary for healthy mental activity and development, what are rational methods of teaching; but as long as text-books are ground out, in questions and answers, just so long will memorizing be the rule for pupils, and the encouragement of observation and originality be the exception. Yet the child can be taught by practical methods and appliances about the admission of light and air to a room, simple tests for the purity of water, about filters, what soils obstruct drainage, why sewerage and drainage are necessary, what to do in accidents and emergencies, etc. The desire of the average child to observe and ask questions can be turned to good account instead of being stifled by rigid routine work. The energy born of observation and the intelligent application of what is learned by observing is healthful. As Herbert Spencer puts it, "Success in the world depends on energy rather than on information, and a policy which in cramming undermines energy, is self-defeating."

If the teaching of physiology and hygiene is to be of service in strengthening the growth and development of individuals and communities it *is* a matter of moment that these studies should be properly imparted.

## THE UNITY OF SCIENCE.*

By M. J. MOLESCHOTT.

ONE of the greatest anatomists of the age and a distinguished jurist were sitting together at the festival of a German university. They were engaged in a friendly discussion as to which of them should, by virtue of his profession, be best known to the world. At last the lawyer surrendered his claim, remarking that the arteries and muscles were the same in America and Europe, while it was doubtful if the ideas of the Roman law enjoyed a like extension. But I do not believe that the illustrious naturalist felt any great joy in the victory he had obtained; for both professors were brave defenders of the universality of science in the highest sense of the word, and were certainly not expressing their most serious thoughts in this moment of by-play. How much, during

* Address at the reopening of the University of Rome, November 3, 1887.

the half-century that has passed since this conversation, the feeling of the unity of science has advanced, and to how great a degree it has entered into the intimate convictions of the most learned men, does not need to be told.

At a time when all students are avowing themselves bonded in the universality of science, the speaker who is called upon to discuss the subject finds himself in the face of an audience whom he has nothing to teach, but from whom he has much to learn.

A natural inclination leads him to consult, first, the biologists, who have probed to the earliest manifestations of life on our planet; and he is seized with wonder at finding that paleontology, emancipated from the curious contemplation of extinct organisms, has risen to phylogeny, and is following in the host of vital forms that order of evolutionary succession which causes the most recent beings to be regarded as the descendants and heirs of their predecessors. Biological paleontology judges the law of successive evolution to be immanent in the development of species and of individuals. It discovers that the development of the most perfect beings on the earth is made after the form of the generations which preceded those elevated organisms, in such a way that every example of ontogenic evolution appears to be a rapid summary of the phylogenic evolution that preceded the appearance of the being the embryology of which is studied.

Every organized form is fitted in as an essential link in a chain of derivation and descent. Nothing is now left of that fancy that saw in the plan of Nature a mass of accidental variations, like the caprice of an author who published at the same time with his finished works all of his rough draughts and printers' proofs.

At the point we have reached, natural history, regarded as biogeny, can not do without paleontology. Zoölogy affirms that there ought to be transitional forms between reptiles and birds, which present many points of contact and traits of fundamental analogy; but such forms are not found among the beings of our age. Paleontology, however, shows that in the secondary or mesozoic age there lived reptiles having the form of birds, and birds having the form of reptiles.

Just as the paleontologist has taken his place among biologists by investigating the characters of successive developments and discovering and reconstructing the relationships of extinct organisms, so the archæologist has, through ethnography and ethnology, without perceiving it, entered the same camp.

It is the same with whatever relates to civilization. Sometimes the parts are reversed. The linguist asks the physiologist to investigate the laws of phonation and to study accents, analyze the quality of the sound of the vowels, and the sounds that correspond with each consonant, among different races and in different prov-

inces and cities; while the physiologist insensibly acquires the skill and erudition of the philologist.

For a long time doctors believed that they had included all the causes of disease in virulent matters, the inclemencies of the atmosphere, abuses of strength and pleasures, and indulgences of passion. The part of parasites was regarded as limited and secondary, and of those, animal parasites were regarded as the most important, while vegetable parasites were not supposed to play any appreciable part. During the former half of this century, the most intelligent persons considered botany as a part of natural history, very fit to discipline the senses and strengthen the understanding of the future doctor, to cultivate the spirit of observation within him, and to exercise him in the construction of syntheses which would permit him to classify the phenomena. The study of botany was valued only as a gymnastics of the intelligence. It was often forgotten after the first years of study, unless it was modestly called to mind to illustrate the difference between one medicinal plant and another, as parsley and hemlock, or a poisonous and edible mushroom. Now, behold the whole camp of etiologists and a good part of the camp of anatomo-pathologists pressing into the minute examination of the lowest plants, most of them belonging to the group of those microscopic fungi which are divided transversely and owe to that division an extremely rapid increase. These fungi are called, on account of the division which they undergo, schizomycetes. In many maladies, and those of the most grave, one of these species of fungus is considered the determining cause of the disease. The schizomycetes are the invisible enemies of the health of man. The chief defense against them is indirect; it consists in taking care that they do not, through hygienic deficiencies, find in the body of man a fertile soil predisposed to receive and feed them. Hence these invisible enemies have forced the doctor to interest himself in botany, if only to convince himself that the presence of a noxious fungus does not inevitably imply a sentence of death. Botany, therefore, is not only an exercise in education and an auxiliary to medicine, but it is also an integral part of medicine and a fertile source of explanations. The unity of botany and medicine is in appearance only on the ground of the infinitely little; but the economy of all organized nature is really displayed in it, the cycle of life which includes death—death from which life, the true phœnix, perpetually rises again.

Physics has higher ambitions. Mother of all the sciences, including metaphysics, and ever young in its indefatigable research, it unites the efforts of a matured experience with those of a legitimate boldness. It takes pity on the despair of the chemist who can not catch in his crucible a piece of the glowing shell of the

stars, and teaches him how to make use of a ray of light to discover the nature of those distant substances, and to make sure that they are the same in the celestial bodies as they are in the terrestrial globe, which is also celestial in its turn.

It is not satisfied with overcoming the obstacle of distance, which seems to be insurmountable. If to economize time is the most effective way of enriching men and states, physics has the best right to aspire to the glory of being the peerless servant of all administrations, both of public and private affairs. The physiologist also has physics to thank for giving him the means, through the decomposition of light, of perceiving in an instant whether the coloring-matter of the blood is more or less oxidized, while chemical analysis can make it clear only after long and difficult experiments.

But, while different sciences assist one another by reciprocally facilitating, checking, and perfecting each other's work, there is one that has a superior part, at once foundation and summit, elementary and transcendent. This science is the base of all the others, and distributes to the most positive of its sisters crowns, the precious stones of which are touchstones. All of my learned hearers will divine that I am speaking of mathematics, the Dutch name of which (*Wiskunde*) signifies the science of the certain, the positive science, absolutely science. This science guides our first steps in the highway of thought; it is so blended with the premises of every deduction, that its truths, accepted by the ages, seem to have imposed themselves as axioms, or theses *a priori* innate to the faculty which we call intelligence, and thereby independent of all demonstration. Now, this hypothesis, widely prevailing as it may be (and it is as universal as the belief that the sun rises), the psychologist shows to be erroneous.*

The possibility even of error proves the initiative which we take in the formation of these axioms. They are merely the summary of our first and quite simple observations—a summary which has taken the mathematical form, and seems, under that form, to approach the absolute. It is mathematics which, in all the sciences of observation, conducts to the most precise conclu-

* Moleschott says, in his "Der Kreislauf des Lebens": "We yet teach children that they can reach the highest summits of thought, without any aid from the senses, by starting from certain premises which they have brought with them at birth as an integral part of their intellect, and for the knowledge of which they have only to appeal to their memory. The mathematician calls these premises axioms, and he persuades children as well as men, when he submits them to them, as, for instance, that the whole is greater than a part, and that the whole is equal to the sum of its parts. And yet no child knows it until he has seen, say a hundred times, that an apple disappears when it is cut into four pieces and these pieces are divided among four persons." See also Helmholtz, "Ueber den Ursprung und die Bedeutung der geometrischen Axiome" ("On the Origin and Signification of the Geometrical Axioms").

sions, whether it is employed in representing in figures the arrangement of the leaves of a plant, or in formulating the law of gravitation, or the law of the enfeeblement of sound and light in the ratio of the square of the distance. It is mathematics that points out perturbations, and imposes limits upon physical laws. It is mathematics that serves to direct the intelligence, whether by showing it how to correct an error of observation, such as Newton had to contend against when he was inquiring if the law of gravitation was applicable to the motions of the moon, or by helping it to ascertain that not all the causes on which a phenomenon depends have been included in a formula to which the facts refuse to adapt themselves. In short, mathematics is a beacon-light and a means of verification. It inspires all the more confidence because it is the only science that has never had to change its direction, from Euclid to Galileo, from Newton and Huygens to Laplace and Lagrange.

It gives form as well as foundation to knowledge. No draughtsman can hold a contest with graphic geometry in any question of figuring the relations of different phenomena that are functions of one another.

Mathematics is the draughtsman of thought. The beauty of the formulas by which it has been the prophetic guide for the other sciences can not be forgotten; as in the discovery, for example, of the series of homologous compounds by which chemistry has been so greatly enriched. This science, which has produced so quick a revolution in the conscience, force, and art of life, owes to mathematics the concept of valences, and consequently the knowledge of the mechanism of substitutions, the variations of which are so infinite as to belie the maxim, "There is nothing new under the sun."

It is mathematics that renders the honors of positive knowledge to ancient times, in that period which, besides having become classic for its art, also laid the foundations of science, and made the Greeks masters of the true as well as of the beautiful; whether with Pythagoras, Euclid, and Archimedes it established the bases of geometry and mechanics, with Aristotle founded natural history, with Hippocrates introduced the art of observing and questioning, or with Plato made the method of discussion an art of reflecting ideas in the mirror of facts.

Hence, the person who sees only labor lost in philosophical researches, is in error. Philosophy (I am speaking of speculative philosophy) has not gone on a journey from which it has not returned, but, having traversed heaven and earth with vigorous will, has come back to tell that it has not succeeded with its *a priori* theories in solving the problems which impose themselves upon all thinking men. That is the confession which Dr. Faust

makes when, after having studied all the sciences, he realizes that no one can attain knowledge without plunging into the reality of life. Yet we do not believe that philosophy has forfeited the glory that is due to every sincere effort, in whatever order of research. It was necessary, indispensable, and certain, that reason, escaping the limits of things, should exhaust itself in tentatives. Did not Plato of necessity create Aristotle, and stoicism Lucretius, in the same way that Bacon and Descartes, Galileo and Kant, were born of scholastic and dogmatic thought?

Philosophy (I am not speaking of speculative philosophy this time) now comprehends that it can aspire to fill only two missions: to be the synthesis of all our knowledge, and to generalize the method which ascends from facts to ideas, persuaded that the idea springs from the fact and does not create it. In this sense philosophy, suffering modifications as time goes on, will be always the synthesis of the known (not of the knowable), and, freed from that which is of speculation and ideology, will remain the guardian mistress of the harmony in which the true, the beautiful, and the good are to be blended.

Thus there remains a task for philosophy that peculiarly belongs to it—one of the noblest tasks—to examine the solidity of the bases of morals, independently of customs and the prejudices of individual nations and times; and ethics is not separable from æsthetics. So understood, philosophy is the science of sciences, or absolutely the science, the guarantee of progress, the guardian of morals, the mediator between science and art, the supreme expression of liberty of thought which admits neither innate ideas nor revelation. We comprehend everything under the ægis of such a philosophy, precisely because method has become single.

The long-cherished contrast between the positive and historical sciences has disappeared, for we are persuaded that the point of departure in this also is observation, that the continuity of facts must be followed step by step in seeking out the law, in tracing the concatenation, in order to rise to the conception that all has become what it was necessary for it to become. Harmony in the universe is inherent to the beginning of things; and if we could embrace them in a single glance we should see that first causes correspond with final causes; and teleology and causality would be merely the two faces of the same medal.

Unity of method conduces to the union of the exact sciences and of historical investigations, of jurisprudence and anthropology, of biology and military art, of politics and statistics. From this marriage have been born the social sciences, which have come to demonstrate that society has its evolution, its exigencies, its diseases, and, in short, its laws like the individual, and that it is necessary to calculate facts and observe their march in order to

be able to act upon the influences on which that march depends and by which it is regulated.

The objective of the social sciences is to neglect no factor of life. It is only by a ponderous and progressive labor that can be realized that amelioration of the social conditions which can never be attained by a sudden leap, but which we can see in fact preparing and asserting itself by a gradual and continuous evolution.

The evolution of mechanics, of which the strongest, most adroit, and most expeditious workman is electricity, is daily reducing the muscular labor of man. By virtue of the principle of the conservation of energy, the diminution of muscular labor is of advantage to intellectual labor, in quantity as well as in intensity. Attention becomes more profound, intelligence more quick, judgment more sure. The danger of the workman of modern times becoming brutalized is, without any doubt, greatly diminished. The workman has become more polite, more reflective, and more human, and is advancing further every day toward the conquest of the more considerable place in society which he merits. Not only the quantity of intellectual labor has been advanced by the technical applications which science has made possible; we have a right to ask also if its quality has not gained still more.

The telegraph and the telephone have made all the world more expeditious, more attentive, more ready in its judgments, and more prompt in its decisions. Recollect the perplexity into which, thirty years ago, a letter demanding prompt advice or immediate assistance would put us. Knowing that we had time, that we should have to wait several hours before sending an answer or beginning a journey, we gave ourselves up to doubts; and, when doubt possesses itself of a man, his judgment is often obscured and his will paralyzed. Now that we have to leap the ditch, to think on the instant, and turn our good-will at once into action, thought takes wings, and our decision is resolute and bold.

In this way Volta and Galvani have become powerful educators. By their scientific discoveries they are teaching our sons to think readily, to will firmly, and to express themselves briefly, in a manner precise and conformed to their thought. A rapid physical means of communication triumphs over torpor of the intelligence, indecision of character, and prolixity in speech. Further, this electric pile has become the mother of the postal-card, another mistress of simple and pertinent words. The later generations know so well how to use these instruments that to some the postal-card is already too large. In a very few lines they can assure friends of continued affection and produce the illusion that one is for an instant enjoying their presence, feeling their caresses, and experiencing the stimulation of their spirit. Economy of time leaves leisure to write short letters, for which there was not

time in Pliny's day; and the exchange of thought has gained as immensely as the exchange of friendly sentiments. In this way it is a fact that every application of science develops the moral force of man.

Man measures the universe, and he measures himself in the rapidity of his thought and will, and finds the relation between the world and himself. He knows that he measures with relation to himself, that he measures with his senses; and in the relations between them and the world, in the necessary relation which unites them, he finds the human absolute. Reducing all the measures to a single scale, he discovers the unity of the science for which there exists a law that embraces all, anthropology. Anthropology examines the nature of man, the civilization of man, his laws, his errors, his poetry, his ideal. This ideal, which must go on ascending in proportion as man attains knowledge of himself, consists in the harmonious development of the species; and this embraces all the factors—the functions, passions, and aspirations—of his moral being. The more the individual assimilates himself to it, the more this harmony makes of man a work of art, the more it gives him the faculty and the right to admire and love his title of man; because he finds the reason of the good and the beautiful rooted in his nature. Anthropology embraces ethics, æsthetics, and history.

Hope comes to fortify the ideal at an epoch when we are comprehending the transformation of force and of form; because, with this conception of the conservation of force, all phenomena and all the moral manifestations of men may perfect themselves without ever striking upon an ultimate limit. Against such an ideal, against such a hope, the shadows of ignorance and the discouragements of pessimism will never prevail. The shadows are afraid of a statue,* and pessimism has no courage but that of despair. But the poet (Victor Hugo) has said with right, "Whoever despairs is in the wrong." He who does not despair and who works carries in his own conscience the fruit and the recompense of his efforts.—*Translated for the Popular Science Monthly from the Revue Scientifique.*

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Prof. Prestwich, in a paper on the date, duration, and general conditions of the last glacial period, estimates the date of the melting of the ice-sheet at from eight to ten thousand years ago. He admits the appearance of man in Europe before the spread of the ice over the continent, and assigns the residence of neolithic man in Europe—although he had probably been established in the East before that date—to some three or four thousand years B. C.

* I mean the statue of Giordano Bruno. The place selected for its site (also a very natural location, and the only one worthy of it), the *Campo dei Fiori*, where it looks upon the spot where the heroic thinker was burned, is a protest against clerical intolerance.

# THE PARLOR-GAME CURE.

By Rev. THOMAS HILL, D. D.,
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SOME forty years ago, a distinguished citizen of Boston was caught, by an intimate friend who entered without knocking, in the very act of reading Bowditch's translation of the "Mécanique Céleste." He excused himself for the unfashionable character of his reading, by saying that he had thought he would refresh his memory of his college-days. But the friend drew from the wife a better explanation. The good man was a heavy stockholder in a company which had been almost brought to bankruptcy by the thefts of a dishonest treasurer; and he was reviving his mathematics as a means of diverting his mind from the unpleasant topic, which had begun to weigh too seriously upon him.

Those who have had no early training in these severer studies, refresh their minds, when wearied with business anxieties and cares, by a lighter sort of reading. The diversion which refreshes and reinvigorates a man must be one that is suited both to his peculiar tastes and to the character of the fatigue or anxiety which has worn upon him. That which interests and refreshes one man may weary another; that which banishes the thought of one kind of trouble, may recall and aggravate the causes of distress to a man whose anxiety or weariness has arisen from a different cause. The "Mécanique Céleste" served a good purpose for our Bostonian; while a novel which turned upon a plot involving breach of trust, and the ruin produced by it, would have been only a means of increasing the sufferer's trouble.

This is the real and substantial value of parlor-games. They serve as means of cure for those sufferings which arise from mental causes; they do so by diverting the mind without overtaxing it. It is true that many parlor-games may be used for gambling—or rather abused—but they are not on that account to be wholly condemned. Indeed, there is, in the very fact of a thing being capable of doing mischief, a presumptive proof that it can do good; by the correlation of forces, any energy can be turned into a useful channel. A substance absolutely inert would be capable of doing mischief only when present in a sufficiently large quantity to impede the useful action. Keeping to our comparison of games to medical agencies, we may perhaps get some light from a curious remark of Liebig. His theory, as we dimly remember it, was somewhat to the following effect: When any article is received into the stomach, a contest begins between the gastric powers and the intruder. If they conquer, the article was

food; if they are conquered, it was poison; but if it is a drawn battle, the article is medicine. To a certain extent, this theory certainly embraces truth; although it is equally certain that it does not cover the whole ground of therapeutics and hygiene.

Pastimes and games are justified to the moral sense by their sanitary value. Cards, dominoes, and the backgammon-board are as manifestly means of health as hair mattresses and ventilating-flues. The dice-box, as used in backgammon, is often more valuable to an invalid than the pill-box. But the very fact that games are thus valuable as medical agents, proves that they can not be a wholesome article of diet; they are not valuable enough to be made a continual occupation; they do not furnish sufficient food to the mind. So far as that, we might apply the Liebig theory to them. If a man were, for example, to take up chess after the manner of Paul Morphy, master all the possible combinations so thoroughly as to be able to checkmate every adversary, and that, with any pawn designated by lot, at the beginning of the game, such a man would evidently have made more than a pastime of chess. It would have been food for his mind; just as really food, although not so valuable, as Euclid's "Elements," or Legendre's "Theory of Numbers." If, on the other hand, a man, without Morphy's talent for chess, should become infatuated with the ambition of gaining Morphy's skill, and should spend a disproportionate amount of time playing, his right hand against his left, then to him the game would be poison. Its sanitary use, as a recreation, is evidently attained only when a man pursues it just far enough to divert his mind completely from the thoughts which were injuring him, and not far enough to make it in itself an absorbing occupation.

The late Prof. Peirce once said that no game, and no toy, ever became permanently popular unless it involved some deep and peculiar mathematical or mechanical principle. He asserted it as a fact of observation, but we never heard him attempt to account for it. The theory which we are ascribing to Liebig furnishes a partial explanation. The presence of this deeper principle, underlying the game, prevents it from being digestible by any except those of strong power. To all others the game may be considered either as a poison, when it is utterly beyond their reach to do anything with it, or else it is a recreation of permanent sanitary value; that is, when the patient can acquire skill in it, but is not tempted to try to fathom its mathematical principle. Pierce's meaning may be illustrated by familiar examples. The child's top, his hoop, his bandelor, his devil on two sticks, all involve the same fundamental doctrines of rotation on an instantaneous axis, which task the mightiest powers of the geometer in their application to celestial mechanics. Ball-playing, quoits, hurling of spears, throwing

at a mark, involve the addition of two other famous mathematical principles; namely, the epicycloids of Hipparchus, and Galileo's law of gravity. Billiards bring in the insoluble mystery of friction, which creates a breach of continuity in the path of the ball. Cards, backgammon, and various games for the evening at home, involve the doctrines of permutations and of chances.

In the ancient astronomy the planets were imagined to be carried on the ends of revolving arms, which themselves were carried by arms rotating more slowly, these latter arms again being carried by arms of still slower rotation. This epicycloidal motion of Hipparchus is evidently closely analogous to the motion of the human hand, which rotates upon the wrist-joint, while the wrist is carried in a circle about the elbow-joint, the elbow in a circle about the shoulder, and so on. The ingenuity of Hipparchus had, as it were, contrived a huge imaginary man, carrying the planet between his thumb and finger. The friction of the billiard-table diminishes the rotation of the ball upon the instantaneous vertical axis at such a rate as to bring it presently to an end, leaving only the rotation upon a horizontal axis. At this moment the curved path of the ball becomes instantly a straight line. Cards involve the smallest prime number, and that in two ways, there being two colors, red and black, and also two suites of each color. Cards also involve the relatively high prime thirteen, and, less conspicuously, the intermediate numbers. They furnish, therefore, the opportunity for an almost endless variety of permutations and combinations; and if these are produced by shuffling, they involve also the doctrine of chances. We ourselves do not know how to play a single game of cards; therefore, on Sydney Smith's principle of never reading a book before he reviewed it, for fear of becoming prejudiced, we can speak of them in an unprejudiced manner. Their universal popularity we have just explained. But it is a nearly invariable rule that the best things are also the worst. Fire is a good servant but a bad master; and strychnine, one of the most valuable of tonics, will kill a man as promptly as it will a wolf. Cards are capable of great abuse, and they have been so greatly abused that many persons interdict their use also. Yet they have a use; and their sanitary value as a recreation and diversion of the mind is, in certain cases and for certain persons, very high. The invalid needs rest, and often finds the best form of rest in the exercise of different powers from those which have become fatigued. This is as true concerning mental as concerning bodily exercise. When a man is tired, weighed down with anxiety and care, or with a continuous application of the mind to one set of questions, his brain is apt to go on automatically, tiring itself and its master, producing even in sleep restlessness and dreams. Such a man obtains rest more easily,

and a sounder, more refreshing sleep, if his mind can be diverted for an hour or two to some different train of thought, which ought to be barely interesting enough to keep his attention without producing excitement or requiring strong exertion.

Two elements which enter into a game are of prime importance—chance and skill. In the latter word we include both manual and mental skill. For example, in cup and ball we have an instance of a game requiring nothing but manual skill; while in jackstraws, it is a combination of chance with manual skill that determines the result. Again, in checkers we have a game of pure intellectural skill, but in backgammon intellectual skill is combined with chance. Skillful physicians prescribe for a patient that kind and degree of exercise which is suited to his case—to one a rocking-chair on the south piazza; to another a good round trot out of town on the saddle. Thus, in the evening games, which shall rest the tired worker, or divert the invalid, there is a great opportunity for wise choice in selecting those which are best suited for the purpose in view. Men of intellectual habits, who need rest for the brain and diversion for the sake of rest, find the greatest benefit in those games which demand constant attention, but comparatively little mental exertion. The late Charles Robert Darwin astonished the scientific world by the immense amount of labor which he successfully accomplished. One secret of his immense power of endurance unquestionably lay in his devotion to backgammon, in which he so frequently passed his evenings. This game has the admirable qualities, first, of demanding imperiously your attention at every throw of the dice; and, secondly, of giving you a comparatively easy question in the use you are to make of the throw. There was even an advantage in the old fashion of invariably calling out each throw in mongrel French before playing; it still more fully occupied the mind with "easy nothings." The preponderance of chance over skill in backgammon is a fourth recommendation of this game for a tired brain. It produces a constant but slight expectation or watching to see what will turn up. In the Russian game, however, it has appeared to us that the preponderance of chance was too great; it does not leave enough demand for skill. This, also, is the objection to dominoes.

In rude antithesis to backgammon and dominoes stands chess. This game can not be said to be popular, in the strict sense of the word, and the reason is evident—it is too severely intellectual. It is a very famous game; so also are Newton's "Principia" and Butler's "Analogy" very famous books. But neither of the three are likely to be found on the sitting-room table as an amusement for either old or young when needing recreation. Moritz Retzsch's marvelous picture of the young man playing chess for

the stake of his own soul has been far more popular than the game itself.

The stake of one's own soul is not often, if ever, consciously made; but one of the abuses to which we have alluded is the habit of staking money or things of money value upon the issue of a game. To say nothing of the moral character of gambling, the stake of even sixpence is just so much detracted from the real interest and value of the game itself. Wagers of every kind, for even the most trifling amounts, are to be avoided; they are essentially bad. But when they take the guise of forfeits or prizes in games, they are doubly mischievous, injuring the utility of the diversion, as well as fostering, to some trifling extent at least, that gambling spirit which is one of the great destructive agencies to the human race.

Another ground on which games may be classified is the manner and amount to which the social element enters into them. Here, again, cards have an advantage, which greatly increases their favor with the people. The social element enters into cards in a great variety of ways. There are games admitting several persons, but requiring all to keep whist; there are games admitting several persons, and allowing free conversation. There are games for two persons, and there are various solitaires. An invalid's hours are often necessarily spent in solitude; and he tires of reading, of whittling, of crocheting, or knitting; and yet tires of idleness. Then a solitaire is valuable; and he may choose, from the solitaires at cards, a kind which shall suit his taste and his needs; since the different solitaires in cards vary greatly, in the amount of thought and of skill required to play them.

The severely intellectual game of chess offers also a numerous set of solitaires. Every chess-column in a newspaper furnishes problems of greater or less difficulty. A diagram gives the position of a few pieces toward the close of a supposed game; and the party to be victor is required to checkmate, in a specified number of moves. Setting your men according to the diagram, you play for both parties; endeavoring to prevent the game from ending so soon, and yet endeavoring, with equal fidelity, to bring it to a close as required.

The new game of halma, which has acquired so sudden a popularity in some parts of the country, furnishes, like chess, an unlimited variety of problems; either one of which may be considered, like any enigma or puzzle, a solitaire. The most general statement of a problem in halma would be, to move a given number of men from one given position to another, in a given number of moves. One problem proposed by ourselves has proved so wonderfully rich in the number of possible solutions, that we

may be pardoned for repeating it here: "Place nineteen men outside a yard of nineteen squares, in a figure symmetrical upon the diagonal of the board; such that the men may all be yarded in nineteen moves." Of course, the problem, in this form, is too difficult for a direct attack. It must be solved by reversing it: "Place the nineteen men in a yard, and bring them out into a symmetrical figure in nineteen moves." At first, it is very difficult to get them out at all, in nineteen moves. As you go on, you find more and more of symmetrical figures, into which you can arrange them. One young friend has found nearly eight hundred figures, arising from only three different ways of making the first seven moves. Another player has discovered nearly twenty ways of taking the first seven moves. This seems (in spite of the fact that some of the symmetrical figures are capable of being produced by different modes of approach), to indicate that there are, probably, four or five thousand different figures which fulfill the conditions of the problem. There is, therefore, in this one question, an unlimited amount of amusement, for those who fancy that kind of work, moving the men out and moving them back, in thirty-eight moves.

These problems in chess and in halma are problems of pure intellectual skill. We chanced, a few months ago, to have had a problem suggested to us, requiring no skill, but depending wholly on chance. Meeting, in a Pullman car, a little Mexican boy, not yet six years old, we were surprised to have him produce a dice-box with five little dice and propose to throw for money. When he found us inflexible in refusing, he began to throw for himself, and, keeping an audible account, credited us, in fun, with the alternate throws. We then began to make a memorandum of the number of pips up at each throw of his five dice. Ten throws were equivalent to fifty throws of a single die, and it so happened that his first ten throws gave one hundred and seventy-five pips; the precise theoretical average of fifty throws of a die. It then occurred to us that some persons might find it an interesting solitaire amusement to record a large number of throws made at successive times. The interest would arise in comparing the actual averages of ten consecutive throws, or fifty, or a hundred; and of consecutive tens, fifties, etc., with the theoretical averages. These comparisons might extend from the average of the number of pips up to the number of doublets, triplets, and other special combinations, produced by consecutive throws, or by simultaneous ones. The labor of calculating the chances (how often, for example, with a pair of dice, doublet aces should occur, and how often they should be instantly followed by quatre ace) should be performed by a person in health, and the invalid amuse himself by simply recording a large number of throws, and seeing how

nearly the actual frequency of occurrence agreed with the theoretical average frequency.

We might mention, also, a number of parlor-games which involve some degree of muscular exercise; and others, like the game of twenty questions, which require vivacity and brightness in the use of language. But the main principles to which we wished to call attention have been sufficiently illustrated by the sedentary games and solitaires which we have already mentioned. The therapeutic value of a game depends upon its adaptation to the individual tastes and needs of the person who takes it up. It must be such as to interest him and keep his attention, and yet not such as to absorb, excite, and fatigue him. His native and acquired tastes, his age and habits of life, the state of his health, the causes of his fatigue, or of his illness—all these, and other similar causes, will influence the effect that any particular game or amusement will have upon him; and in the exercise of a sound common sense, by himself and his friends, he will select and vary his amusements as carefully as he selects his various occupations, or chooses his diet.

## DRIFT-SANDS AND THEIR FORMATIONS.

FIVE large sand-tracts may be designated in Europe—the German lowland, extending from Holland through Germany to Russia (about 340,000 English square miles in area); the Dano-Germanic island plains (20,000 square miles), including Schleswig-Holstein, Denmark, and Jutland; the Austro-Hungarian Danubian plain (about 42,000 square miles); the Landes of France (about 5,400 square miles); and the sea-coast sands of Russia, Germany, Belgium, Holland, and France. These extensive regions have, for the most part, either been made amenable to cultivation, or at least protected from the assaults of the winds by preservative plantations. Tracts of this sort are often much more fruitful than we are accustomed to suppose them to be. But there are also in Europe large fields of sand which are hardly if at all covered with plants. They are the dunes and sands on the coasts of Prussia, Pomerania, Jutland, many of the Danish and Frisian islands, Hanover, Oldenburg, Holland, Belgium, and France. Large systems of dunes extend in France from Brittany to near the Pyrenees. But there are also exposed sand-tracts in the interior. The most extensive of them are in Hungary, of which the most important is probably the sand-barren of the Banat. It forms an oval about thirty-five kilometres long by eleven kilometres broad, and has an area of nearly four hundred square kilometres. It presents the appearance of a rolling region with elongated hills,

often resembling mountains, which for the most part follow the trend of the steppe, as well as the direction of the prevailing wind, which is here from southeast to northwest. The hills rise, counting from the nearest valleys, to a height of fifty-five metres, inclining gently on the windward side, but presenting a steep slope on the lee. This steppe has indeed always in historical times included bare spaces, varying in number and extent according to the existing state of cultivation. Till the beginning of the present century the bare drift-sand had so gained the upper hand that there was in the middle of the tract a continuous extent of one hundred and fifty square kilometres in which grass and shrub-land could be found only in small spots and streaks. Only the northeastern and southeastern part of the steppe consisted of grass-land, in which bare spaces were likewise not wanting. Many other such sand-districts might be named. For example, there were in the County Pesth, in 1809, nearly 1,600 square kilometres of more or less bare, but not continuous sands.

Let us inquire into the origin of these sand-masses. The open sea is usually bordered by deposits of sand and gravel. Where the shore rises in steep rocks, these deposits are concealed under the water; but where the coast is alluvial, as is generally the case in the smaller seas, the whole shore consists of sand and shingle; and the sea-drift extends up upon the dry land. The waves are constantly bringing up new material to the beach, chiefly consisting of fine sand. A storm stirs the water to a considerable depth, pushes the sand forward, and bears it with the waves high upon the shore. On the retreat of the waves, a part of the sand remains, because it is specifically lighter than water. When the storm has subsided, and the sea has withdrawn to its proper limits, the sand becomes dried, and falls under the power of the strong, restless wind, which takes up all the fine particles, and when it rises to be a storm wind some of the coarser ones too, and carries them away into the country. Here it meets impediments of various forms and efficiency; then it drops its load irregularly, and gradually piles up along the shore those hills which are generally known as sea-coast dunes.

This edging of dunes which borders the flat sea-shore is of various breadths in different places. In some places it becomes so piled up as to cause a retreat of the waves. New dunes are constantly formed farther toward the sea, and the dune-zone is widened. Sometimes the widening is effected by the emigration of the bare dunes toward the interior. In other places the dunes are broken into by the sea-water, and suffer loss of breadth.

When there is no overflowing of the shore or breaking up of the dunes, the system usually consists of three more or less connected rows of hills. First, the fore-dunes, which first receive the

material added by the waves; then the high dunes back of them, which, receiving the drift-sand, gradually rise in height and become better fitted to protect the mainland against wind and sand; third, the inner dunes, a series of low hills lying back of the high dunes, which are formed of the sand that is blown over the high dunes. [This division is, however, theoretical, and not always recognizable in the fact.]

The two sides of the dune slope at different angles. On the windward side the rise is gradual, at an angle seldom of more than from 5° to 10°. But the other side is much steeper, and usually offers an angle of 30°. The variations that appear are explained by differences in the cohesion of the sand; coarse sand forms a steeper slope than fine sand. The dunes have an average height of some forty-five or fifty feet; but there are some of greater altitude. In Jutland, for example, and on the Frisian and Courland low ground, and in the Landes, they rise to from one hundred and fifty to two hundred feet. In breadth, they vary from three hundred to three thousand feet; but they reach an extraordinary development in the Landes, where breadths of thirty thousand feet are not rare.

The large sand stretches in the interior were formerly sea-bottoms. Another origin has been sought for the Banat sands of the Hungarian steppe, in the supposition that they are a product of the Danube, which, tremendously disturbed by southeastern storms in the vicinity of Palanka, has thrown its sand-weighted spray into the air to be carried far inward, dropping its heavier constituents along the way. This hypothesis needs to be mentioned only to be contradicted.

It can hardly be supposed that an inland drift-sand district has lain bare during historical time, or since that long-past epoch when the retreating waters left it dry. On the contrary, sand constantly acquires an increasing verdancy through the unceasing efforts of Nature, and becomes at last covered with a thick carpet of the lower plants, or with wood, and thereby fully protected against the wind. This gradual process of binding goes on the more speedily when it is not interrupted by man. The presence of a former coating of humus is easily proved by digging into the sand; for, everywhere that the sand-hills are removed, dark-colored strata appear, which were certainly once surface-soil covered with plants. The wind-blowings occasionally bring to light carbonized relics and reed-shaped holes which are unmistakably derived from tree-roots. Cylindrical massive or hollow tufa formations are also observed, the shapes, direction, and ramifications of which likewise point to roots; and they have probably been formed from roots through the infiltration of calciferous water.

The origin of the bare sand-spots may be traced to the agency of man. The immigrating nomadic populations required for their herds not wood, but pasture and tillable land, and mercilessly cleared away the forest. The land thereby became arid, and wherever a pasture or meadow was not established, the sand, deprived of its covering, became a prey to the winds. Even if this view be regarded as a hypothesis that can not be proved, it is at least illustrated and made comprehensible by events which are historically authenticated or are still taking place. When the Turks were driven out of Hungary, the sand-tracts, for the most part, lay waste. The Italian Griselini, who traveled through the Banat under a commission of the Empress Maria Theresa, wrote: "For nearly eight German miles in length and from nine to ten thousand fathoms in breadth, the sand, when it is not moist, is so fugitive that it is taken up by the wind and deposited in little hills of various heights."

The once well-clothed level sand region of Tidsvild in Zealand, where a religious house was built in the twelfth century, was, at a later date, through carelessness and the destruction of the woods during the Swedish invasion of 1658–'60, given up to the ravages of the winds. Wide tracts and even valleys, like Tomb, and, in 1730, Tibirke, were overwhelmed with sand. The Government was aroused by these disasters, and earnestly undertook the work of irrigating the sand. The enterprise was successful, a fact of which a memorial stone erected in the territory bears witness, in an inscription in Danish, German, and Latin, relating, "The drift-sand was watered at the command of Kings Frederick and Christian, by the faithful industry of Warden Frederick von Granu and Roehl's skilled hand." A similar instance of the letting loose of the drift-sand through the careless destruction of the woods is recorded in East Prussia.

There are cases even now where, through the greed or ignorance of man, bare sand-tracts are allowed to be formed in the midst of cultivated lands. This takes place, for example, where grass-land is pastured to excess, or the turf is trodden out by the too frequent passage of large herds over the same spot. Exposure to the direction of the prevailing winds, subjecting broken spots to frequent sweepings and promoting the washing out of ruts by rains, poor farming, and careless burning of the shrubbery are also dangerous, and in Hungary have led to the enactment of laws regulating the treatment of sand-lands.

As has already been mentioned, the noxious quality of sand consists not so much in its own infertility as in its being subject to transportation by strong winds and deposition upon fertile spots, where it buries and destroys the lower vegetation. When it is thus driven or flies away from its original place, it receives

the name of drift or flying sand. While single grains have but little cohesive force, sand behaves toward the wind like water; and the method of the formation of dunes is undoubtedly very similar to that of the formation of waves. If the sand was quite even and horizontal and the wind blew regularly in the same direction, it would not get at the sand. But the surface of a sand-bed is not even; it consists of the roundish heads of the sand-grains that form the upper layer. The wind blowing over them moves them out of their place, and, the individual grains being roundish, they roll. The continuous pressure of the wind extends their movement, and these grains striking upon the projecting grains that are still at rest, disturb them, and the movement spreads more and more. The smaller grains at last no longer touch the ground, and only the heavy ones retain the springing character of their motion, till the wind is restrained and weakened by some fixed objects—plants or buildings—and is compelled to let part or all of its load fall. These objects are thus exposed to be submerged in sand; and hence it is that we so often see fields of low plants and even villages overwhelmed. It is interesting to observe the different ways in which different objects receive the wind. A tight wall does not catch the sand immediately in front of itself. A furrow is formed just before it, through the generation of side-currents, which receive the sand from actual contact with the wall. There is then formed a sand-ridge parallel to the wall, but at first separated from it by a hollow; but afterward, when the ridge has become high enough to shield the wall from the wind, the side-currents are extinguished, and the sand advances to it. The sand driven over the wall by the wind falls at a considerable distance behind it. A striking illustration of this process was formerly to be seen at the church of Altpillau, on the Baltic. The village, which had previously surrounded the church, was removed farther to the east on account of the presence of the sand, but the church had to be left where it was. A sand-ridge some twelve or twenty feet high was formed around it, but nowhere reached the walls of the building; and while the congregation were obliged to climb over the ridge, they never found the church-doors buried. A broken wall, an open fence, or a quick-set hedge behaves quite differently toward the advancing sand. No furrow is formed in front of it. The air-current forces a large part of its load through the openings, but is so weakened by the obstruction that it drops it before and behind the fence. A little wall is formed around a tree-trunk, which is not, however, of great extent behind it. In isolated bushes and tufts of herbage, the intervals between the single stalks are filled up with sand, and a little mound is gradually formed.

Like the inland drift-sands, the dunes of the coast also migrate.

Fortunately, it is only the dry sand that is destitute of cohesion. Were this not the case, a whole dune might be taken up and removed to another spot during a very heavy storm. Sand possesses considerable capillarity, by virtue of which the ground-water at its bottom rises through its substance; so that an apparently dry dune is so moist only a few feet below its surface, as to form a compact mass. Rain, however, only temporarily lends it a certain degree of fixedness. The air present between the grains of sand permits to rain-water a slow percolation, so that it has been observed, particularly with fine sand, that water ascends in it from below more rapidly than it descends from above. Rain-water, not being all sucked up by the sand, has to run down the slope, and, therefore, not rarely washes deep furrows in the mass. Sand that has been moistened by rain is more tractable after drying than before it was wet, because the interposition of the water has separated the grains, and they are more easily moved by the wind. The wind can only wear away the surface of a dune. It therefore takes the direction of the ascent of the dune, and carries the sand with it. A space free from wind is formed upon the top of the dune, where the larger grains fall upon the ground and run down on its other side, forming a nook in which they are enabled by their cohesion to remain, while the finer grains are carried farther by the wind. The dunes thus maintain their general forms while slowly advancing. The progress of the dunes has been frequently observed, and attempts have been made to measure it. A series of observations for twenty-three years in the barrens of the Banat gives an average of two metres a year. It is estimated, according to Count Adelbert Baudissen, on the island of Sylt, that the dunes are moving from west to east at the rate of four metres a year. Hagen names a rate of five and a half meters a year for two dunes on the Friesian lowlands, and Krause, four metres a year for another one. Elie de Beaumont describes dunes in Brittany that have moved since 1666 at the rate of seven metres a year; and Behrendt gives the average annual progress as from five to six metres.

A traveling dune is stopped by no obstacles. With the irresistibility of an element only slower than water or fire, it presses forward, burying field and wood, and even whole villages. The spires of church-towers may still be seen projecting out of the sandy sea of Brittany, testifying to the presence of former dwelling-places, there. The whole northern point of Jutland has been given up by man to the advancing sand.

In the seventeenth century an old churchyard was found, over which a dune had taken its course, on the Courland lowlands north of Kranz. A sandhill that separated the hamlet Sarkan from the parish-village Rositte, and which had to be crossed by

the pastor, has since then disappeared in the gulf. Great dunes now cover the village of Lattenwalde, which was so laid waste during the Seven Years' War by plundering, quartering of the Russians, infectious diseases, and fire, that the sand had only a heap of ruins to cover up. The village of Kunzen, with its church and seventeen homesteads, was ruined in the same way in the course of the last and the beginning of the present century; and now the dune, continuing its journey, has permitted the skulls and skeletons of the former churchyard on the west side to be again exposed.

The village of Pillkoppen has had a remarkable fate. The inhabitants left the place about the middle of the last century, and founded New Pillkoppen, at about a mile away. Then the dune went on in an unanticipated course, and old Pillkoppen has risen anew since the third decade of the present century; but the sand is already again a foot high in the potato-garden of the new school-house.

A fine wood near Schwarzort has been almost systematically destroyed by a dune advancing toward the southeast. It was composed of primitive oaks, lindens, and firs, and was in the year 1800 about five kilometres long, while now the dune has hardly left a kilometre and a half of it. Schumann says of this wood that "in about ten years after the tree has gone into the southern side of the moving dune, it emerges again from the north side. But the boughs which have been dried out and withered up during the interval are broken, ground up, and reduced to atoms as soon as the sand has left them. The same occurs later to the rotted stems. Few of these trees show more than an inch over the surface of the sand; and it is only the thicker and hardier trunks that can maintain themselves so as to project from two to five metres over the diminished dune. With most of them the sap-wood disappears down to the surface, the bark with all, which, however, is still present beneath. Frequently, the bark alone is left, while the wood has rotted away. Such trees are marked only by a hardly perceptible bark-ring, and the careless traveler is in danger of falling into the holes they have left." The time may be fixed with an approach to accuracy when the whole wood shall have been destroyed, and Schwarzort itself will be threatened. Schumann estimates the yearly progress of the dune at twelve metres, and gives the last trees still eighty years before they shall be overwhelmed.

In the small islands west of Jutland, the progress of the dunes is illustrated by a diminution of the islands themselves. For the sea eats the shore away year by year as it is left bare, and when the dunes have marched over the whole islands, and precipitated themselves on the eastern side of them into the sea, the islands will

have disappeared, and ships will find free sailing-ground where men are now living and cattle and sheep are pasturing.

Of course, man struggles to defend himself against this enemy. The only way of counteracting its movements is to cover the sand with vegetation and make it inaccessible to the attacks of the wind, and this is not very easily accomplished. The sand consists chiefly—seventy-five to ninety-eight per cent—of uncultivable quartz sand, in which only easily satisfied plants can be made to grow. The wind is, besides, sometimes so strong on the sea-coast as to permit lowly plants to grow only with difficulty, and trees not at all. Sand is, moreover, so fugitive a substance that plants are liable to be torn from it before they have taken firm root. But these hindrances can be overcome, though with difficulty. One of the first instances in which a sand mass was thus tamed was in Denmark in 1738. The sands of the Landes in France have been bound with entire success. Measures of precaution were undertaken in the neighborhood of Dantzic about the middle of the last century. As everywhere else on the Baltic, the dunes had been covered by Nature, except on the side toward the sea, with firs and bushes of all sorts, and thereby protected against the wind. But the ignorant greed of men had removed the wood, grubbed up the stumps, allowed cattle to tread the heaths at will, and treated the dunes so recklessly that their protective covering disappeared, and their sand masses were exposed to the winds. Consequently, at the beginning of the eighteenth century the villages of Kleinvogler and Schmergrube were wholly and Polski partly overwhelmed. It was not till about the middle of the century, when the dunes nearer to Dantzic began to encroach upon the fir-wood appertaining to the city, that measures of protection were thought of. The first measure suggested was the planting of fences of fir-boughs on the comb of the dune, to intercept the sand brought by the wind. This scheme failed. The deposits of sand in front and rear of the hedges made the constant planting of new barriers over the old ones necessary; and the dune increased in height at an alarming rate, involving a great danger of the sudden breaking down of the ridge, when the destruction effected by the sand would be worse than if it had been let alone.

In this dilemma, the Natural History Society of Dantzic, in 1768, offered a prize for the best answer to the question, "What are the most effective and cheapest means of preventing the overflow of the lowlands with sand, and of stopping the further growth of the dunes?" Titius, Professor of Natural History in Wittenberg, gained the prize, by an essay in which he indicated the restoration of the coast-woods as the only permanent remedy, and the planting of a sand-grass (*Arundo arenaria*) as the measure with which the immediate emergency might be met. His sug-

gestion was not carried out. But when Dantzic became part of Prussia, in 1793, the Government took the matter energetically in hand. Burgher Sören-Biörn, who was of Danish birth, recommended the application of Titius's plan, and was intrusted with the redemption of one of the most threatening dunes. Having accomplished this work to the general satisfaction, he was made inspector of plantations, and in this capacity superintended the work till his death in 1819.

Since then, the work of fixing the drift-sands has been begun in several places. As a generally approved preliminary measure, a fore-dune is first formed. This is done by planting between the dune and the sea two parallel fences, about six feet apart, and rising some eight feet above the level of the sea. These structures weaken the force of the sea-winds so much as to cause a considerable proportion of the sand to fall between them, or on either side of them. Thus a dune is formed. It is secured by planting several rows of *Arundo arenaria*—a grass that can not be buried by sand, because the more it is covered the better it flourishes, throwing out strong roots from below, and even growing in length above. The fore-dune protects the real dune against waves during storms, against a part of the wind, and against a continued overflow of new sand. Time is also gained for providing a covering of plants. First the sand-grasses are planted, then herbage-plants, then heaths and willows, and finally, in the least protected places, trees, of which firs are preferred.

The cultivation of the inland drift-sand is somewhat easier; but in either case it requires continuous, active work. Seeds of suitable sand-plants are sown and covered with limbs, straw, etc., till the resultant growth has become strong enough to stand against the wind. The ground is gradually improved by means of these plants, till at a later period useful plants can be cultivated, and the former desert can be turned into tillable land or wood. The conversion is, indeed, a tedious process, but the result is profitable.—*Translated for the Popular Science Monthly from Das Ausland.*

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THE people of New Zealand are proud of the assiduity with which science is cultivated in that colony, and of its scientific literature. The New Zealand Institute is helped by a government grant. Under the provision of its act of incorporation, that any local society having fifty members can claim the right of affiliation with it, and of participation in its funds and privileges, the various scientific circles have been brought into communication with one another, and a friendly rivalry has been promoted. The twenty volumes of the "Transactions and Proceedings" of the Institute are filled with valuable memoirs on almost every scientific subject. A number of "Students' Manuals," issued at moderate cost, have had a salutary influence in interesting the young in science.

## THE FUTURE OF THE NEGRO.

IT is difficult for men who study history to read the discussion now raging on the progress of Islam in Africa without recurring to the old question—which so greatly interested the last generation, and is now so seldom started—the question of what the negro is really like. There are not many left among us, we imagine, though there are some here and there, who doubt whether he is a man at all; but the conflict of opinion about him is of the most extreme kind, so extreme as to be almost unintelligible. One set of observers, with whom Captain Burton, as we understand his writings, agrees in the main, hold that he is a nearly irreclaimable savage, a being who can not be ruled except by terror, and who is by nature incapable of rising to the level attained by the white, and even in many respects by the yellow and the brownish man. They think his savagery instinctive, his laziness incurable, and his sensuality far in excess of anything observable in Europe. They declare Africa an accursed continent chiefly because of the negro, and welcome frightful narratives, like Mr. St. John's account of Hayti, as demonstrating past all question the accuracy of their theory. Other observers, again, including many missionaries and some explorers, are friendly to the negro, think that the repulsion caused by his external aspect makes ordinary men unjust to him, and declare that he is, when not oppressed, essentially a docile creature indisposed to vindictiveness, and, though not clever, fairly ready to receive instruction, which, they further add, may occasionally be carried up to any point attainable by the white man. Such observers, among whom we should class keen-eyed Mrs. Trollope, who had rare opportunities of studying the race, and keener-eyed Mrs. Stowe, think the Uncle-Tom kind of negro not rare, and evidently hold that when bad, he is vicious as a European may be, rather than innately savage. A third class maintain that the negro, if carefully observed, is found to be exactly like everybody else, with the same passions, the same aspirations, and the same powers, with one most remarkable exception. He can not rise in the scale beyond a certain point. The originating power of the European and the imitating power of the modern Asiatic are not in him, or not in the same degree; and he remains under all circumstances more or less of a child, bad or good like other children, but never quite a man. It is added by this class, and in part by the one mentioned before it, that the negro woman is, on the whole, better than the negro man, with more industry, more fidelity, and decidedly more capacity for the gentler virtues. The third opinion is, so far as we know, that of the majority of missionaries, of most residents in the West Indies not being em-

ployers of labor, and of all Americans, and they have been many, to whom we have opened the subject. Americans seem to us, as a rule, to think most kindly of the negro, to be entirely free from fear of him, to be annoyed with oppression practiced on him, but to be quite hopeless about his future. He will not advance, they think, and would recede but for the white man.

History certainly bears these Americans out. Throughout its whole course, in the Old World as in the modern one, under the most extreme variety of circumstances, no negro of the full blood has ever risen to first-class eminence among mankind. Not only has there been no negro philosopher, or inventor, or artist, or builder; but there has been no negro conqueror, nor, unless we class Said, Mohammed's slave, as one, and Toussaint l'Ouverture as another, any negro general above the rank of a guerrilla chief. There seems to be no reason for this except race. People talk of the seclusion of the negro: but he has always been in contact on the Nile with the Egyptian, or the Greek, or the Roman, in South America with the Spaniard, and in North America with the English-speaking Teuton, and he has learned very little. It is objected that he has been always a slave; but so was everybody else in the Roman period, most modern Italians, for example, being the descendants of the white slaves of the Roman gentry. Moreover, why does the negro put up with that position, when the Chinaman, and the red Indian, and even the native of India will not? It is said that he has been buried in the most "massive" of the four continents, and has been, so to speak, lost to humanity; but he was always on the Nile, the immediate road to the Mediterranean, and in West and East Africa he was on the sea. Africa is probably more fertile, and almost certainly richer, than Asia, and is pierced by rivers as mighty, and some of them at least as navigable. What could a singularly healthy race, armed with a constitution which resists the sun and defies malaria, wish for better than to be seated on the Nile, or the Congo, or the Niger, in numbers amply sufficient to execute any needed work, from the cutting of forests and the making of roads up to the building of cities? How was the negro more secluded than the Peruvian; or why was he "shut up" worse than the Tartar of Samarcand, who one day shook himself, gave up all tribal feuds, and from the sea of Okhotsk to the Baltic, and southward to the Nerbudda, mastered the world? One Tartar family was reigning at one time over China, Tartary, India, and Russia. Why has the negro, who is brave as man may be, alone of mankind never emerged from his jungles, and subdued neighboring races? Why has he never invented a creed of the slightest spiritual or moral merit, never, in fact, risen above fetichism? Above all, why has he remained in Africa, for three thousand years at least, without

forming empires or building stone cities, or employing a common medium of intercommunication? Mr. Blyden says he has formed cities full of busy life and commerce; but have they ever been better than encampments, and why have they not lasted? We who write certainly do not believe in the incurable incapacity of the race, for we know of Bishop Crowther and Mr. Blyden, and have talked with negroes apparently as thoughtful and as well instructed as any Europeans; but we confess that the history of the race remains to us an insoluble puzzle, except upon the theory that there are breeds of mankind in whom that strangest of all phenomena, the arrestment of development, occurs at a very early stage. The negro went by himself far beyond the Australian savage. He learned the uses of fire, the fact that sown grain will grow, the value of shelter, the use of the bow and the canoe, and the good of clothes; but there to all appearance he stopped, unable, until stimulated by another race like the Arab, to advance a step. He did not die, like the Australian. He did not sink, like one or two varieties of the red Indian, and of the aborigines of South Africa, into a puny being hardly like a man; but he stopped at a point as if arrested by a divine will. There is not a shadow of proof that the negro described by Werne differs in any way from the negro of the time of Sesostris. It is not quite certain even that the race, when started again, would, as a race, go on improving. The Haytians, who are Christians, who are free, and who are in the fullest contact with great white races, are believed to be retrograding; and only the hopeful would believe in the future of American slaves, if they were to be expelled, as De Tocqueville thought they would ultimately be, to the islands, or, as is infinitely more probable, should the war of races ever break out, to Central America.

As far as we see, nothing really improves the negro except one of two causes—cross-breeding, and catching hold of some foreign but superior creed. The cross-breeds of the Soudan and of South Africa seem to have some fine qualities—matchless courage, for example—and under a strict but vivifying white rule might, we fancy, be brought in a century or two up to the Asiatic level. They produce generals, at all events, and chiefs with some tincture of statesmanship, and have poetry and a folk-lore of their own. Those negroes, again, who have embraced Islam do show a certain manliness, a capacity for aggregation, and a tendency, at all events, to form kingdoms, and organize armies, and obey laws, which are the first steps toward a higher civilization. It is not a high civilization, for, when all is said, a Mohammedan negro is not an ideal of humanity toward which Europeans can look with any feeling of enthusiasm; but still, it is higher, far higher, than the condition of the African pagan. The negro who embraces

Christianity, again, while he remains in contact with the white man distinctly advances. "Uncle Tom" is an abnormal specimen, it may be, and we are not inclined to place the moral condition of the negroes of the Southern States very high; but still, they have displayed a perfectly wonderful absence of vindictiveness toward the former slave-owners, obey the ordinary laws with fair regularity, and keep themselves above starvation by the labor of their own hands. The best of them, moreover, rise far beyond this point, the South containing both doctors and lawyers who, by the admission of the whites, are thoroughly competent men; and it may be said of the whole body that, though not equal to any European community of the same extent, they are far superior to any four millions of pagan negroes who could be selected in Africa. As they can not owe this rise in the scale to slavery, which at the best could only drill the negroes to industry, and at the worst must beget a permanent distaste for labor, the change must be owing to Christianity, plus the operation of laws based upon that faith. It follows that the largest group of negroes under civilized observation, the descendants, as is believed, of four widely distinguished tribes, have been raised in the scale of humanity by embracing a rude form of the Christian faith. The total conclusion, therefore, as yet justified by evidence, is that intermarriage, especially with the Arab, improves the negro tribes, that they gain in manliness by embracing Islam, and that they gain in the social virtues by embracing Christianity, the latter to a degree measured by the depth and earnestness of their faith. At home, when unconquered and unconverted, they do not advance, and the point still doubtful is whether, when left to themselves, they will not, even when converted, again recede or stop. The Abyssinians, who are Semites, have been Christians for ages. The conclusion is not very satisfactory; but it is certain that races of imperfect powers exist—e. g., the Australian aborigines—and that Providence does, for unknown purposes, occasionally waste even fine races—e. g., the Maoris—who will, to all appearance, die out, having fulfilled no function at all, not even that of preparing the way for the ultimate occupants of their country.—*Spectator.*

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A curious economical study is afforded by the four groups of the Scilly Islands and Orkneys—which are as a rule prosperous—and the Western Hebrides and Shetland Islands—which are miserable—under similar outward conditions and surroundings. Those conditions and the rule of race failing to account for the difference, Mr. T. H. Farrer suggests that the explanation may be found in the fact that in Scilly and Orkney the industries by which men live "have become separated, specialized, and perfected, each practiced and developed by separate classes as a separate pursuit," while in the Hebrides and the Shetlands the crofter has to be at the same time a kind of Jack at all trades.

## SKETCH OF SPENCER F. BAIRD.

IN Prof. Baird we have a conspicuous example of a man who cultivated science for itself alone. While in no sense careless of his own fame, he was always willing to prefer to it the advance of knowledge; was ready to rejoice at every new contribution, though it might tend to forestall something of his own; and was often willing to aid constructive rivals, as is expressed in one of the tributes brought out by his death, by access to his own papers and workings, at the expense of his own priority in the same field. Of another trait of his scientific character Major Powell says, "Baird was one of the learned men of the world, and to a degree perhaps unexampled in history he was the discoverer of the knowledge he possessed."

SPENCER FULLERTON BAIRD was born in Reading, Pa., February 3, 1823, and died at Wood's Holl, Mass., August 19, 1887. He was of English, Scotch, and German descent, his paternal grandfather having been of Scotch parentage, and his ancestry on the mother's side English and German. One of his great-grandfathers was the Rev. Elihu Spencer, one of the war preachers of the Revolution, on whose head a price was set by the British Government. His father, Samuel Baird, was a lawyer in Reading, who is described as having been "a man of fine culture, a strong thinker, a close observer, and a lover of Nature and of out-of-door pursuits." He died when the son was ten years old. Spencer was sent in 1834 to a Quaker boarding-school, kept by Dr. McGraw, at Port Deposit, Md., and in the next year to the Reading Grammar School, and in 1836 he entered Dickinson College, whence he was graduated when seventeen years old. His tastes for natural history and collecting were developed early, and were shared by his elder brother, William M. Baird, whose companion he became in collecting specimens of the game-birds of Cumberland County, which the elder brother had undertaken in 1836. Six years later they published conjointly a paper describing two species, supposed to be new, of the genus *Tyrannula*, Swainson. A number of specimens, fruits of their joint work, are now to be seen in the National Museum at Washington. He pursued his studies in general natural history in the field for several years after leaving college, making long pedestrian excursions for observation and collection, and organizing a private cabinet, which became the nucleus of the Smithsonian collections. In 1841, when eighteen years old, he made an ornithological excursion through the mountains of Pennsylvania, walking four hundred miles in twenty-one days, and the last day sixty miles. In the following year he walked more than two thousand two

hundred miles. He unquestionably derived much benefit in his studies from his intercourse with Audubon, which began in 1838. He contributed many facts and specimens for the "History of North American Quadrupeds" and the "Ornithological Biography." Audubon gave him a considerable part of his collection of birds. He had intended to accompany Audubon as his secretary in his six months' expedition to the Yellowstone in 1840, but was prevented by ill-health.

He read medicine, and attended a winter course of lectures at the College of Physicians and Surgeons in 1842; but he never formally completed the course, and the degree which he received in 1848 from the Philadelphia Medical College was an honorary one. In 1845 he was made Professor of Natural History in Dickinson College, to which chair Chemistry was afterward added. In this position—teaching the seniors in physiology, the sophomores in geometry, and the freshmen in zoölogy—he also found time to keep up his scientific researches, and to make long collecting expeditions to the Adirondacks in 1847; to Ohio in 1848, for the collection of types of the fishes of the State; to the mountains of Virginia in 1849; and to Lake Champlain and Lake Ontario in 1850. "In his own collections during this period," says the author of a tribute in "The Nation," "were developed those business-like methods of arrangement and detail for facilitating study which were subsequently adopted and extended, not only in the institutions which grew up under his supervision, but by nearly all other American scientific museums, and which form a system that for usefulness and efficiency has no parallel in any foreign museum up to the present moment."

In 1850 Prof. Baird was appointed, upon the recommendation of the Hon. George P. Marsh, assistant secretary of the Smithsonian Institution. In this position he was brought into immediate relations with Prof. Henry, under whose inspiration the institution was just getting fully under way. It was the ambition of that chief to make the influence of the institution diffusive rather than concentrative. It was to be the depository of all the collections which should come into the hands of the Government. Prof. Henry would not have it to monopolize these collections or be so managed that only those might enjoy the advantages to be derived from their study who should be immediately connected with it; but he considered that, while in the study of the specimens and the publication and dissemination of the results it might properly join forces with the Government and with private persons, its part of the labor and expense should be as purely supplementary to other agencies as circumstances might permit. "The policy of the institution under Henry was to disperse as widely and freely as possible the worked-up material, and to enlist in the process of

elaboration the aid and enthusiasm of every American naturalist, each in his own field." To make this policy a success, such as it eventually became, continues the author of the tribute in "The Nation," "required qualifications of no ordinary kind. Not only must the work of mediation be guided by the most advanced biological science of the time, but the individual intrusted with it must possess a spirit of impartial liberality, tempered by a sound discretion in business methods, a thorough knowledge and just estimate of men, an untiring patience to meet the peculiarities and caprices of the independent and often one-sided specialists whose co-operation was essential, a geniality to enlist the willing but unscientific collaborator, and an instant detection of humbug in every guise. Providentially for the future of natural science in this country, the need and the man met in the selection of Prof. Baird. In qualifications for the work, he stood pre-eminent —a head and shoulders above any man of his time, and perhaps above all other scientific men of any time."

When Prof. Henry died in 1878, the choice of Prof. Baird to succeed him as secretary of the institution was almost a matter of course, and it is superfluous to say that his designation to that position was by the unanimous vote of the board of regents.

It is worthy of note in connection with the record of Prof. Baird's work in the Smithsonian Institution that the first grant made by the Institution for scientific exploration and field research was in 1848, "to Spencer F. Baird, of Carlisle, for the exploration of the bone caves and the local natural history of southeastern Pennsylvania." "This transaction," says Mr. William B. Taylor, in a memorial address, "appears to have been the occasion of first bringing the young professor to the favorable notice of the Smithsonian director, Prof. Henry, and of initiating between the two a mutual respect and friendship that continued throughout their several lives." Prof. Baird had the charge of the department of explorations, of his work in connection with which, Prof. Goode says that, "in his reports to the secretary, published year by year in the annual report of the Institution, may be found the only systematic record of Government explorations which has ever been prepared. From 1850 to 1860 several extensive Government expeditions were sent to the Western Territories, and it became the duty of Prof. Baird to enlist the sympathies of the commanders of these expeditions in the objects of the Institution, to supply them with all the appliances for collecting, as well as with instructions for their use, and also, in most cases, to organize the natural history parties, nominate the collectors, employ and supervise the artists in preparing the plates, and, in many instances, to edit the zoölogical portions of the reports. The fitting out of such expeditions was only a small part of the work; from the

beginning until now there have been numerous private collections, deriving their materials, their literature, and, to a considerable extent, their enthusiasm from the Smithsonian Institution, and consequently in correspondence with its officers. The Smithsonian 'Instructions to Collectors,' which has passed through several large editions, as well as numerous circulars written with a similar purpose, were prepared by Prof. Baird in connection with this department of his work. As a result of this extensive work of organization, a large number of young men have been trained as collectors and observers, and not a few among them have become eminent in various departments of science. In addition to this extensive branch of his work, the assistant secretary had, from the start, the charge of certain departments of the routine work of the Institution; the system of international exchanges, for instance, which had ever been one of the leading objects of the Smithsonian Institution, was organized by him in its details." Major Powell, speaking of the comprehensiveness of his methods for enlisting co-operation in these enterprises, says: "When our army was distributed on the frontiers of the land, he everywhere enlisted our scholarly officers into the service of science, and he transformed the military post into a station of research, an Indian campaign into a scientific expedition. Scott, Marcy, McClellan, Thomas, and many other of the great generals of America, were students of natural history and collectors for Baird. When our navy cruised around our shores, its officers were inspired with that love of Nature which made every voyage of military duty a voyage of discovery in the realms of natural science." Explorations, railroad-surveys, and travels throughout the world, were thus utilized by him in the interests of science. The main duty of the assistant secretary, however, was the development of the natural-history collections. Prof. Baird had brought his private collection to form a nucleus around which the others should be gathered. The Institution was in the possession of a few boxes of minerals and plants; and the collections of the Wilkes Exploring Expedition were under the charge of the National Institute, to be ultimately, as was provided in the act of incorporation of the Smithsonian Institution, transferred to it. To the care of these collections, and the management of the National Museum which has grown up from them, Prof. Baird brought the methods of work which had been developed in his own experience at Carlisle; and these methods are substantially those on which the museum is organized and conducted to-day. His faithful attention to the arduous duties of his position here did not prevent his publishing a considerable number of elaborate original memoirs, among which were a catalogue of North American serpents, the "Mammals of North America," and three

works on birds, in one of which Thomas M. Brewer and Robert Ridgway were his collaborators; the scientific departments of the Harpers' periodicals; and numerous official reports.

The office of Commissioner of Fish and Fisheries was instituted, without salary, in 1874, with the attendant duties of inquiring into the decline of valuable fisheries on the coast and lakes of the United States, investigating its causes, and seeking for measures to prevent it and to restore the supply of food-fishes. Prof. Baird was appointed to this office. Under his direction it grew yearly in importance, and made the results of its work more widely and directly felt in all parts of the United States. An impulse was communicated by its workings to the efforts of the several States in caring for their fish-supplies, which became more systematic and regular; and the effects of its labors are now palpable in all parts of the Union in the restocking of our rivers and ponds, which has been to a large extent practically effected through the co-operation of the Commissioner's industrious assistants and the State and local authorities. Its work, according to Prof. G. Brown Goode, is naturally divided into three sections: The systematic investigation of the waters of the United States, and the biological and physical problems which they present—in which Prof. Baird included not only the life-histories of species of economic value, but also the histories of the animals and plants on which they feed or on which their food is nourished, the histories of their enemies and friends, and of the friends and foes of their enemies and friends, as well as the currents, temperatures, and other physical phenomena of the waters in relation to migration, reproduction, and growth; the investigation of the methods of fishing, past and present, and the statistics of production and commerce of fishery products, with particular attention to the influence of man upon their abundance; and the introduction and multiplication of useful food-fishes throughout the country, especially in waters under the jurisdiction of the General Government, or those common to several States, none of which might feel willing to make expenditures for the benefit of the others. The published reports of this commission, which seem to grow in volume every year, form extensive treasuries of knowledge on every subject which can be referred to these three headings. By means of these reports, and his various articles bearing on ichthyology, he was instrumental, according to Mr. W. H. Dall, "in bringing together for the use and benefit of the English-speaking public the largest body of facts relating to fish and fisheries ever prepared and digested for such purposes by any individual or organization. Recognized by experts of foreign countries with one accord as the most eminent living authority on economic ichthyology, America owes to his fostering care and unwearied

labor the existence of a whole generation of ichthyologists, breeders of fishes, and inventors of appliances of all sorts for use in connection with the taking, preservation, and increase of these animals. . . . Whether germane to the subject of scientific research or not, the most narrow specialist can hardly judge an allusion to the grandeur of the methods by which the food-supply of a nation was provided, hundreds of rivers stocked with fish, and the very depths of the ocean were repopulated. . . . In a few years we may fairly expect to see the food-supply of the entire civilized world materially increased, with all the benefits which that implies, and this result will in the main be owing to the unremunerated and devoted exertions of Spencer F. Baird."

As estimated by Mr. Dall, the proportion of the vertebrate fauna first made known by Baird to the total number recognized at the time as North American, varied from twenty-two per cent of the whole to forty per cent in different groups. His method of study of new material was as far removed as possible from bookishness. Prof. Baird's early life, Mr. Dall adds, "had included so much of exercise in the shape of long pedestrian journeys with gun and game-bag, so much familiarity with the wood-life of his favorite birds and mammals, that it would have been in any case impossible to class him with the closet-naturalist; while to this knowledge he added a genius for thorough, patient, and exhaustive research into all which concerned the subject of his study, and a wonderful inventiveness in labor-saving devices for labeling, museum-work, and registration. He had a wonderful capacity for work." These qualities, and others consonant with them, enabled him to draw conclusions which subsequent accumulations of material have verified in a surprising manner.

Prof. Baird was a man of great literary activity. The number of his works and contributions down to the end of 1882, recorded in Prof. G. Brown Goode's "Bibliography," is 1,063, of which, however, 775 are brief notices and critical reviews contributed to "The Annual Record of Science and Industry," 31 reports relating to the work of the Smithsonian Institution, 7 reports upon the American fisheries, 25 schedules and circulars officially issued, and 25 are volumes or papers edited; but many of these papers also contain important original matter. Of the remaining 200 papers, the majority are formal contributions to scientific literature. Some 20 or more of the papers were prepared conjointly with some other author—his brother, William M. Baird, Charles Girard, Messrs. Cassin and Lawrence, or Messrs. Brewer and Ridgway. Of all the papers, 73 relate to mammals, 80 to birds, 43 to reptiles, 431 to fishes, 61 to invertebrates, 16 to plants, 88 to geographical distribution, 46 to geology, mineralogy, and paleontology, 45 to anthropology, 31 to industry and art, and 109 to ex-

ploration and travel. In them all, 361 new species are described. The earliest contribution in the list is the description of two new species of the genus *Tyrannula*, Swainson (1843), which he prepared in conjunction with his brother. An application of bichromate of potassa to photographic purposes, published in 1844, was employed by him in taking leaf photographs, a collection of which, preserved in the National Museum, has been one of the standard resources of American palæophytologists, and has been used in the preparation of many of the works on the fossil botany of the United States. In a "Summary of Suggestions in Regard to Future Operations of the Smithsonian Institution in the Department of Natural History" (1851), the purpose is outlined not to attempt collections of all natural objects, but rather to gather up such materials for investigation as have been comparatively neglected by others. In the same paper occurs a statement in reference to Japan which sounds curiously now when the activity and co-operation of the Japanese in scientific matters are so conspicuous. After speaking of Japan as a region in some respects more closely allied to our country than even Europe, the author remarks: "Unfortunately, there are at the present time almost insuperable difficulties in the way of procuring Japanese specimens, the Dutch naturalists being the only ones who have succeeded in exploring even the shores of this country. Little can be done, therefore, except by exchange with the museums of Holland." In 1851 he translated from the German and edited the "Iconographic Encyclopædia," an elaborately illustrated dictionary of physical facts and art, of unquestioned merit, which had great currency till it was superseded by later works reflecting the progress of science. The volume on "Birds," in the series of the Reports of the Explorations and Surveys for a Railroad Route from the Mississippi River to the Pacific Ocean (1858), was prepared by Prof. Baird, with the co-operation of John Cassin and George N. Lawrence. Prof. Coues says, respecting it, that "the appearance of so great a work, from the hands of a most methodical, learned, and sagacious naturalist, aided by two of the leading ornithologists of America, exerted an influence perhaps stronger and more widely felt than that of any of its predecessors, Audubon's and Wilson's not excepted, and marked an epoch in the history of American ornithology. . . . Such a monument of original research is like to remain for an indefinite period a source of inspiration to lesser writers, while its authority as a work of reference will always endure." "The Annual Record of Science and Industry," which was published for several years under Prof. Baird's editorial supervision, was made up from the items and articles that had been published during the year in the Harpers' weekly and monthly periodicals. Many of them were original

contributions to knowledge, never elsewhere published. Others were critical reviews or notes upon the current literature of science. Others are abstracts of scientific papers, with the addition of explanatory or illustrative remarks. Others still are abstracts of papers for the most part in the words of the authors of the papers or of some other reviewer. A modification of the plan of the "Record" was introduced in 1877, under which, instead of merely general summaries of progress in various branches, with abstracts of papers, more space was given to the former part, and the summaries were prepared by eminent specialists, and published under their names.

A beautiful picture of Prof. Baird's personal character and of his unselfish devotion to science is given in the tribute which was published in "The Nation." In selecting men for particular positions or lines of work, "he was very rarely mistaken in his judgment. In his position he was called upon to advise in nearly all Government appointments which had a scientific bearing, direct or indirect, and the total number of selections which he determined during his career must have been many hundreds, and have included nearly every available person among the younger generation of students. The most surprising element in it all, to those cognizant of the details, was the calm impartiality which he brought to the task. No thought of self seemed to enter into his calculations. . . . It is evident that, in promoting the studies of others, and in holding as a trust for the general benefit the vast collections which passed under his control, opportunities must have been numerous for giving precedence to the progress of his own researches rather than of those of others engaged in the same lines. In such cases, we believe, he never hesitated, and the decision against himself was in more than one instance known by him at the time to be of pecuniary as well as of scientific disadvantage to his own interests. He never spoke of this sort of self-denial, and it was in a majority of cases known but to a few persons incidentally connected with the researches in question. . . . Two things," the author of the tribute says in conclusion, "his experiences may be said to have lacked—he never had a personal controversy, nor, so far as we have ever heard or had reason to suspect, an avowed enemy."

In illustration of his modesty, which amounted almost to timidity, and was yet so engaging as to secure him advocates whenever he presented his views, Mr. Garrick Mallery relates that he once joined Prof. Baird on his way to a meeting of the Philosophical Society of Washington, where he was to deliver an address on a subject connected with fish propagation. During the walk, says Mr. Mallery, "he spoke of the struggle at that moment between the sense of duty requiring him to take part in the pro-

ceedings of the society, and his reluctance to making any formal address. This modesty—indeed, timidity—in an eminent writer and thinker whose lightest words were sure of eager attention in a society composed mainly of his personal friends and wholly of his admirers, was the more remarkable because his address, presented a few minutes later, was most pleasing in its delivery as well as instructive in its substance.

About a year before his death, Prof. Baird was informed by his medical adviser that complete rest from mental exertion was necessary to the restoration of his nervous energies. He accordingly obtained the appointment of two assistants to relieve him of the burden of his cares, and sought the recuperation which he needed. In the summer of 1887 he returned to his work by the sea-side, to Wood's Holl, where he had created the greatest biological laboratory in the world; and in that laboratory, says Major Powell, "with the best results of his life-work all about him, he calmly and philosophically waited for the time of times. Thursday, before he died, he asked to be placed in a chair provided with wheels. On this he was moved around the pier, past the vessels which he had built for the research, and through the laboratory, where many men were at work at their biologic investigations. For every one he had a word of good cheer, though he knew it was his last. At the same time, along the pier and through the laboratory, a little child was wheeled. 'We are rivals,' he said, 'but I think that I am the bigger baby.'" Then he was carried to his chamber, where he soon became insensible.

Of the honors given to Prof. Baird, besides the usual supplementary college degrees conferred by Dickinson College and Columbian University, he was awarded the silver medal of the Acclimatization Society of Melbourne, the gold medal of the Société d'Acclimatation of France, the first honor-prize (the gift of the Emperor of Germany) of the Internationale Fischerei Ausstellung at Berlin, and the decoration of the Royal Norwegian Order of St. Olaf. He was a member of the council of the National Academy of Sciences, was permanent secretary of the American Association in 1850 and 1851, was trustee of the Corcoran Art Gallery, president of the Cosmos Club, a trustee of Columbian University, and a member of the Historical Society of New York. Among foreign societies in which he held honorary or other memberships, were the Linnæan and Zoölogical Societies of London, the Linnæan Society of New South Wales, the New Zealand Institute, the Geographical Society of Quebec, and Royal or other scientific societies in Vienna, Lisbon, Batavia, Buda-Pesth, Cherbourg, Jena, Halle, Nuremberg, and Berlin. More than twenty-five species and one genus in zoölogy, and a post-office in Shasta County, Cal., bear his name.

# CORRESPONDENCE.

## THE COTTON-STRING CURE.

*Editor Popular Science Monthly:*

SIR: Last October an article appeared in your "Monthly" entitled "Strange Medicines," by Miss C. F. Gordon Cumming. To her very interesting list I would like to add a strange remedy, or method of cure, which has come to my knowledge since reading the above-mentioned article. To this day, in some parts of Indiana, there is practiced what is called "*measuring*" for "*flesh-decay*." As far as my information goes, this remedy is only applied to infants. By "flesh-decay" is meant the pining or wasting away sometimes noticed in babies—who, for no very apparent reason, become fretful, thin, and puling. In such cases, in regions where the superstition I am trying to describe prevails, instead of calling in a regular physician, some old or middle-aged woman is sent for to "measure" the sick child. The process is performed thus: The baby is undressed and laid flat on a bed, as flat and straight as possible; then any common cotton string is taken in the hands of the performer, and carefully and accurately, from the crown of its head to the soles of its feet, the string is stretched over the body, to ascertain its exact length. This length is cut off and given the parents of the child, who are told to bury it in the earth in some obscure corner; and the belief is that when that string begins to decay, the child will begin to recover. My informant, who recently came to this State from Indiana, has seen this done, and knows of its being done many times. I can not find out how the supposed gift to cure thus comes to be credited to certain persons. As far as the observation of my informant went, in cases where the "measuring" process was used to cure "flesh-decay," the sick child, when it did begin to improve, began to do so much sooner than the buried cotton string would have in all probability begun to decay. That babies sometimes took a decided turn for the better after the "measuring" process can, it seems to me, be accounted for in this way: Sick people, and especially children, are, by the most eminent physicians and experienced nurses, recognized to be very susceptible to the feelings of those around them: i. e., if those around are very anxious and discouraged about their condition, it has a depressing influence on the invalid; whereas an atmosphere of cheerfulness and hope helps them to recover. In the above case, the parents and relatives of the sick baby who has been "measured," having perfect faith in the efficacy of the cure, would, after the performance, surround the little sufferer with an atmosphere more favorable to its recovery. Besides this, as near as I could find out, the persons used to wield this cotton-string cure were fat, motherly old dames, whose manipulations of the sick child while smoothing it out on the bed to get it straight, would be likely to have a soothing, revivifying effect. But I am here entering on that mystic theme, the relations of mind to matter, which I feel far too unlearned to discuss. Yours truly,

MRS. A. J. TOWNER.

SANTA ANA, CAL., *April* 17, 1888.

## THE DEMAND FOR SCIENTIFIC BOOKS IN CHINA.

*Editor Popular Science Monthly:*

SIR: Mathematics and astronomy have been somewhat successfully studied in China during two or three thousand years; but geography, geology, botany, zoölogy, human anatomy and physiology, chemistry, and physics have been unknown in native literature. Many dreary volumes have been written, by Chinese authors, upon plants, animals, and ethnology, with curious myths, fables, and superstitions set forth as facts. In spite of the vast bulk of its pseudo-scientific literature, no true science can be said to have existed in China until it was introduced from the West, by the Jesuit missionaries, in the fifteenth century. Since that time, and especially during the last few decades, many books of European origin have been translated into Chinese, and a goodly number of volumes of a scientific and technical character have been prepared by Protestant and Catholic missionaries, and by foreigners in the service of the Chinese Government. The number of such books became considerable, but no organized system for their sale or distribution throughout the empire had existed until, in 1885, Mr. John Fryer, of the Kiangnan Arsenal in Shanghai, established, as an experimental and philanthropic undertaking, a Chinese "Scientific Book Depot," for the purpose of facilitating the spread of all useful literature in the native language. Elementary books on the various sciences studied in Western nations were offered for sale, with works on mechanics, engineering, surgery, therapeutics, and translations of Wheaton's "International Law" and Loomis's "Differential Calculus." The catalogue contained over two hundred scientific and educational treatises, translated or compiled and published in Chinese, under foreign management, with a selection of about two hundred and fifty sound and instructive works of native origin. The price of the books ranged between two cents and sixteen

dollars, the average being ten cents. During the first year the expenses of the "Scientific Book Depot" were covered by the profits on the sale of four thousand five hundred dollars' worth of books, maps, and charts. During the second year branch depots were opened at Tientsin, Hangchow, and Swatow, and the total sales for the year amounted to six thousand dollars. During the third year depots were added at Pekin, Hankow, Foochow, and Amoy, and the sales of books largely increased, so that about seventeen thousand dollars' worth of books had been sold by the end of 1887, and some of them had found their way to the most distant parts of China, and also to Corea and Japan. At least a hundred and fifty thousand volumes of this scientific and educational literature had been disposed of, in addition to considerable numbers of maps and charts.

The demand for Western learning has been greatly augmented during the last year by a remarkable change in the scheme of the competitive examinations whereby successful candidates for literary degrees obtain honors and offices. In the past, only a knowledge of the native classics, with skill in the use of the native hieroglyphics, has been required of the scholar. Now, geography and natural philosophy have been added to the subjects for examination, and this action of the Government has turned the attention of students throughout the empire in a new direction. The indications are that China is to follow Japan in the path of progress in Western science and philosophy, though it may be with the slow step that accords with the magnitude of the nation.

ADELE M. FIELD.

SWATOW, CHINA, *February*, 1888.

# EDITOR'S TABLE.

### *CULTURE AND INTELLIGENCE.*

THERE is a decided improvement in this country in favor of what is known as "culture." Between summer schools of philosophy, Chautauqua courses of study, and various other schemes of similar nature, we have an almost embarrassing choice of means for intellectual improvement. Young people all over the country are studying the great masterpieces of literature, ancient and modern. Now it is Dante, now it is Chaucer, now it is Victor Hugo. There is no doubt at all that this is useful work; at the same time there is just one caution, as it seems to us, to be given. In all this study what is supremely wanted is an objective point; otherwise we shall have, as the result of it all, a lot of people taking pride in their literary *bric-a-brac*, and yet with minds ill furnished for every-day purposes—destitute, that is to say, of a vigorous practical intelligence. We might, perhaps, without danger of falling into serious error, go so far as to say that some of the tasks prescribed by the organizations to which reference has been made are not in every case suited to the minds that attack them. A person of naturally comprehensive mind, capable of taking a wide survey of things, and with daily occupations that tend to promote mental balance, may undertake an exhaustive study of Dante without throwing the general structure of his or her thought and knowledge out of all symmetry; but we should not feel like guaranteeing an equally harmless result in the case of some of those whom we see bending over such tasks, and who, if they take possession of Dante in any real sense, will have something on hand out of all proportion to the volume and mass of all their other mental acquisitions put together. In cases such as we have in view there is just this alternative: Dante is either learned in some effective fashion, or he is not learned to any purpose worth mentioning. In the former case there ensues a certain lop-sided development of culture, in the other we have a mind more or less spoiled by a mere show of knowledge and the affectations to which superficial acquisitions seldom fail to give rise.

The main point, however, to keep in view, and that toward which our caution is directed, is that all knowledge should be rated in exact proportion to the effect it has in promoting a sound

practical intelligence. In so far as the studies to which we refer make for intelligence in the true sense, they are to be commended and valued; but, in so far as they stand in the way of the acquisition of knowledge or of practical arts better adapted to develop the judgment, and in a general way to produce a robust intellectual constitution, they are to be deprecated. We are rather of opinion that the training which the majority of people chiefly require, is one that will enable them to pronounce sure judgments on questions of limited range, leading them on gradually to efforts of wider scope just as their knowledge and experience are enlarged. A lack of common sense goes very ill with pretensions to superior culture; yet the two are not unfrequently associated. A fine appreciation of Dante's poetry seems like misplaced intellectual luxury, when we find that the person possessing it is unable to say yes or no to some comparatively simple question, or unable to help himself or herself in some very slight intellectual difficulty, or to throw off the thralldom of silly and misleading phrases. "*C'est magnifique*," one is tempted to exclaim, "*mais ce n'est pas la vie!*" Splendid, no doubt, but not real life! We should, therefore, propose that those who engage in these fine studies—capable, under suitable conditions, of yielding most valuable results—should check their progress from week to week and month to month by asking, and trying to ascertain, whether their judgment is being developed, whether in the common things of life they are moving with a firmer step, whether they more readily put aside flimsy pretenses and specious seemings, and pierce more truly to the heart of the matters with which they have to deal. What we all want is better order in our daily thoughts, a clearer vision, a firmer courage. True culture of course implies progress in these directions; but much that passes for culture does little or nothing either for the mind or for the character. Much depends on the end we keep in view. If we study great authors for the sake of having, as it were, an elaborately furnished drawing-room in our minds, we shall get about the same amount of benefit as people commonly get from elaborate drawing-room furniture; but if we study them so as to gain a wider outlook on the world through understanding their thought and duly estimating the conditions under which they wrote—if, moreover, we prove ourselves from time to time, to see whether we are really gaining in mental power—the benefit to us may be very great. We rejoice at every sign of increasing intellectual activity throughout the country, and only ask that it may all be dominated by practical ends and made subservient, not to individual vanity, but to the best interests of American civilization.

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### *EDUCATION NOT A FUNCTION OF THE STATE.*

WE noticed quite a ripple of discontent some time ago in educational quarters, particularly over certain remarks of ours tending to show that education was a matter for the family and for private co-operation, rather than for the state. One respected correspondent asked if we wished to deliver education over to the haphazard of private competition, and we replied by suggesting that there was rather more of haphazard in the politics that necessarily entered into state education than in the methods of the business world. Well, it so happens that public attention and criticism have lately been directed to the public-school system of our own highly-favored metropolis. And with what result? Why, that the system in question, which had often been lauded to the skies as a model of efficiency, as a shining example of what state authority, coupled with the taxing power, could effect in the field of education, has been found wanting at almost every point, vitiated through and

through by the methods of the politician, and half-strangled in the bonds of routine. So great has been the dissatisfaction—we might almost say, dismay—at the discovery, that we hear of the formation of a committee of citizens who propose to charge themselves with the duty of watching the action of our educational authorities, and, if possible, bring the working of the state machine into measurable accord with the reasonable demands of the community—demands predicated upon a knowledge of the results which well-directed private enterprise is made to yield. So, then, we first of all arm the state with full power for all purposes of public education, and then, when the business falls—as fall it must—into the hands of the politicians, and these proceed to act according to their natural instincts, we organize volunteer committees to infuse a little of the breath of life, a little of the vigor of private enterprise, a little of the true spirit of science into the unwieldy organization we have called into existence. We abandon private effort through a conviction that it will not meet the case, will not educate the people fast enough, and then we resort to it again in order to make the governmental machine move. Surely, under the circumstances, we are entitled to ask why private effort and enterprise should ever have been abandoned, why education should ever have been mixed up with politics at all. If we have so many prominent citizens prepared to act as a kind of Vigilance Committee to keep the politicians, to whose care our educational interests have been committed, from violating or mismanaging their trust, surely the same citizens might do much toward organizing a system of education for the people, and making it work for the general advantage. We know it is taken for granted to-day that parents will not pay, directly, for the education of their children. In less enlightened days they were prepared to do so, and to make considerable sacrifices for the purpose; but in these days, having tasted the sweets of free schools, they regard education as something which should not entail any visible or appreciable sacrifices. The assumption, no doubt, is largely based on fact, but can it be claimed that the change is a happy one? If not, if it is an unhappy one, can we too soon set about turning the current of people's feelings in another direction? We do not propose to discuss the question at any length at present, but merely wish to point to the fact, which recent events in this city have rendered notorious, that all is not for the best in the nominally and reputedly best possible system of education. Here, in New York, the system has, to a large extent, broken down. It is seen not to be a system of education in the true sense, but a system the main elements of which are political, and which, consequently, feels no impulsion toward improvement. The committee of citizens are no doubt armed with good intentions, and we highly applaud their action in coming forward at this juncture; but we fear their zeal will wane before the steady persistence of the enemy. To hand over education to the state is a step easier to take than to retrace; and the evils of the political management of education are very much easier to protest against than to cure.

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## LITERARY NOTICES.

A History of Political Economy. By J. K. Ingram, LL. D. With preface by Prof. E. J. James, Ph. D. New York: Macmillan & Co. Pp. 15 + 250. Price, $1.50.

The author of this book is the writer of the article "Political Economy" in the latest edition of the "Encyclopædia Britannica," and the book is, for the most part, a reproduction of that article. Prof. James, in his preface, characterizes the present treatise as "the first serious attempt by a properly qualified English writer to present a view of the progress of economic thought," and adds that it "will compare favorably with any

work of similar compass in any other language." The book is designed to aid the mode of studying this science which is insisted on by the so-called "historical school" of political economists lately arisen. It aims to trace the successive economic doctrines of the past, in connection with the conditions of the time in which each one appeared. Passing quickly over the economic thought of ancient and mediæval times, the author enters upon the modern period, which he divides into three phases. In the first phase, or during the fourteenth and fifteenth centuries, the "Catholico-feudal system" was breaking down, while a new order, the commercial, was rising beneath it. In the second phase, the collapse of the mediæval social structure is followed by the advance of the central government, which, while promoting the growth of commerce, levies tribute upon it to obtain the necessary supplies for military operations. The conditions of this time give rise to the "mercantile school" of political economy. In the last phase—during the eighteenth century—a spirit of individualism arose, and the dogma of *laisser faire* was received with general favor. This tendency, in the absence of the moral discipline partly established in the middle ages, led to the domination of national selfishness and private cupidity. But the rising elements—science and industry—are bringing with them a discipline more effective than the old, and the effort to press forward in the path which they point out gives the character to the period in which we live. The author then proceeds to indicate that the respective features of the second and third phases are reflected in the contemporary economic speculation; those of the first, he says, can scarcely be said to find an echo in any literature of the time. He gives an exposition of the mercantile doctrine, with comments on each important economic treatise which appeared during the prevalence of the tendencies which formed the mercantile school. In treating the doctrine of the third modern phase, or the system of natural liberty, the author takes up first the economic writers of France, Italy, Spain, and Germany before Adam Smith, and follows these with an extended review of Smith's teachings. The later economists of England and the Continent next receive attention, and a few pages are devoted to those of America. The rise of the historical school in the chief countries of Europe and in America is then traced. In conclusion, the author says that political economy has been heretofore governed to its detriment by the methods of metaphysics, and that its progress depends on the substitution of scientific methods; that it must be studied in its relations with the science of sociology which includes it; and that the doctrine of right which lay at the basis of the system of "natural liberty" must be replaced by a new doctrine of duty regulating the co-operation of each class and member of the community.

THREE CRUISES OF THE UNITED STATES COAST AND GEODETIC SURVEY STEAMER BLAKE, in the Gulf of Mexico, in the Caribbean Sea, and along the Atlantic Coast of the United States, from 1877 to 1880. By ALEXANDER AGASSIZ. Boston and New York: Houghton, Mifflin & Co. Two vols. Pp. 314 and 220. Price, $8.

THE author styles this work "a contribution to American Thalassography," meaning by that word the science which treats of oceanic basins. While we have had narratives of explorations with general summaries of results and special treatises and papers on particular points, which may altogether cover the whole subject, there has previously been no American work treating it comprehensively and systematically; although the fruits of English research have been embodied in the masterly books of Wyville Thomson and Wild. The expeditions of the Blake were by no means of minor importance among the enterprises for investigation of the deep seas. They covered a less extent of territory than the Challenger Expedition, but the region in which they operated is among the most interesting divisions of the ocean in the lessons which it affords concerning the relations of currents and temperature with the development and distribution of organic life; and its well-defined limitation made a thorough and nearly exhaustive survey all the more feasible. That the survey has been fruitful in results, in both the physical and biological departments, is attested by this careful and well-arranged presentation of the facts which were learned from it. Condensing the narrative into a very few pages, the author goes at once to the consideration of the immense variety of

facts which the expeditions have added to knowledge, separating them according to their classes, and relating those of each class topically. Mr. Agassiz may call himself a veteran in thalassographic work, for his connection with it began in 1849, when, as a boy, he accompanied Prof. Agassiz in his cruise of the Bibb off Nantucket. He afterward, in 1851, served as the professor's aid in his survey of the Florida Reef. Afterward he reported upon a part of the collections made by Pourtales in the Bibb in deep water in 1867–'68. Since then he been almost continuously engaged on deep-sea work. In the brief chapter in which is embodied the narrative of the expeditions are given some observations, with pertinent illustrations, on the physiognomy and structure of the smaller West India Islands. In the first volume, after a full account of the equipment of the Blake for its work, including Sigsbee's improvement in sounding-apparatus, and a "Historical Sketch of Deep-Sea Work," the characteristic features are general discussions of the fundamental facts and principles ascertained in the research. The chapter on "The Florida Reefs" embodies a study of the manner in which the peninsula of Florida and its hemming reefs originated and have come to their present condition—in which Darwin's theory of coral reefs is found not to apply. Next is considered the "Topography of the Eastern Coast of the North American Continent," of which only the most general features were known before the explorations of the Blake. The further presentation of the general principles comprises the discussion of such topics as the "Relations of the American and West Indian Fauna and Flora"; "The Permanence of Continents and of Oceanic Basins"; "Deep-Sea Formations"; "The Deep-Sea Fauna"; "The Pelagic Fauna and Flora"; "Temperatures of the Caribbean, Gulf of Mexico, and Western Atlantic"; "The Gulf Stream"; "Submarine Deposits"; and the "Physiology of Deep-Sea Life." All these papers are of great physiographical importance, and present at considerable length and in detail the results obtained by the Blake expeditions, supplemented by those derrived from the Challenger and other investigations. The second volume is occupied with fuller and specific descriptions of the various forms of deep-sea life obtained by the surveys and dredgings, beginning with a summary review of the "West Indian Fauna," and continued with chapters, illustrated by original figures, either prepared for this work or borrowed from the office of the Coast Survey, on "The Fishes," "Crustacea," "Worms," "Mollusks," "Echinoderms," "Acalephs," "Polyps," "Rhizopods," and "Sponges." The essentials to every good book, a list of figures and an index, are not forgotten, but are given in a full and satsfactory style.



AMERICAN FISHES. By G. BROWN GOODE. Illustrated. New York: Standard Book Co. Pp. 496. Price, $5.

THE rule which has guided Prof. Goode in selecting, from the 1,750 species indigenous to our waters, the fishes to be described in this book, is to include "every North American fish which is likely to be of interest to the general reader, either because of its gameness or its economic uses." The author gives the physical features of each fish, tells its range and season, its habits in regard to feeding, migration, and breeding, with something about methods of capture, and value as food. Mingled with these facts is much curious information about the different names of fish in different places, many exciting fishing adventures, and appropriate quotations in prose and verse from Izaak Walton and other writers, both old and recent. "This volume has been prepared," says Prof. Goode, in his prologue, "for the use of the angler, the lover of nature, and the general reader. It is not intended for naturalists, and the technicalities of zoölogical description have therefore been avoided. . . . A figure of almost every species discussed is presented, by the aid of which any one interested in fishes can determine the correct zoölogical name of the form before him." To prevent a possible mistake as to the scope of the work it may be well to repeat the author's caution that it contains "no discussions of rods, reels, lines, hooks, and flies, and no instructions concerning camping out, excursions, routes, guides, and hotels." The field occupied, however, is wide enough to make the book interesting to a large circle of readers, and its reliability may be inferred from the author's intimate

acquaintance with the subject, which made him the first choice as successor to Prof. Baird in the office of Commissioner of Fish and Fisheries. His own work, too, has been supplemented by that of the late Commissioner, and of Dr. Jordan, Dr. Bean, Capt. Collins, Mr. Earll, and Mr. Stearns. The classification followed is the system elaborated and advocated by Dr. Gill.

THE STORY OF CREATION: A PLAIN ACCOUNT OF EVOLUTION. By EDWARD CLODD. Illustrated. London and New York: Longmans, Green & Co. Pp. 242. Price, $1.75.

THE purpose of this book is to give a view of the doctrine of evolution throughout the realm of Nature, and of the kind of evidence which supports it. The book is divided into two parts—descriptive and explanatory. In the former, the relations of matter and power in the universe, and the chief features of the solar system are touched upon, while the past life-history of the earth and an account of the present life-forms are given more at length. In the explanatory part, much the same order is followed. Beginning with the universe, the accepted theory of its becoming and growth is stated; then follows a discussion of the origin of life, after which the question of the origin of species is taken up, and the proofs of the derivation of species are given. Finally, the author enters the field of social evolution, and shows the application of the doctrine to psychology, society, language, art, science, morals, and theology. He insists on a distinction between morals and theology, but does not join issue in the vexed question of the relations of science and religion. The style of the text is popular and picturesque, and the volume is abundantly illustrated.

THE GEOLOGICAL EVIDENCES OF EVOLUTION. By Prof. ANGELO HEILPRIN. Illustrated. Philadelphia: The Author. Pp. 99.

IN this brief sketch, which is extended from a discourse delivered at the Academy of Natural Sciences of Philadelphia, Prof. Heilprin presents a popular view of some of the evidences in support of organic transmutation afforded by geology and paleontology. He shows first that in geologic time "there has been a steady advance in the type of structural organization from first to last—not a necessary elimination of forms of low degree, but an overbalancing of these by forms of a more complicated or higher grade of structure." He then traces back the history of several groups of animals, showing that by gradual modification they are derived from ancestral forms which are connected also with other and very dissimilar modern groups. In the greater part of this discussion, data drawn from the vertebrate animals are used, but the author adds, in closing, a few cases drawn from the mollusks, which present equally striking proofs of modification. The book is exceedingly well adapted to promote a general intelligent belief in the doctrine of evolution.

IN NESTING TIME. By OLIVE THORNE MILLER. Boston: Houghton, Mifflin & Co. Pp. 275. Price, $1.25.

THIS volume belongs to a class which is happily becoming more common than formerly, namely, accounts of observations of nature. The habits and actions of birds, both free and in confinement, form the subject of the book, and the modest introductory note claims for the sketches only that they are genuine studies from life, not that the facts are all new to science. The glimpses at bird-life which the author gives have a freshness and sprightliness that make them intensely fascinating reading, while they have also an instructive value due to their revelations of bird habits and character.

A TREATISE on *The Fundamental Principles of Chemistry* has been written by Prof. *Robert Galloway*, of London (Longmans), which differs widely from the common text-books on chemistry. The author holds that the ordinary chemical works intended for beginners follow too much the cyclopædic plan of great reference books, and he quotes Prof. J. P. Cooke as saying of such works: "To the great mass of learners the study of these text-books is uninteresting and profitless, for before the student is made familiar through long laboratory practice with the materials and processes described, such a book is little more to him than a catalogue of names, to which he attaches no significance." The present volume is more like Prof. Cooke's "New Chemistry" than any

other chemistry with which American teachers are acquainted. It is a presentation of principles without much descriptive matter. The first part of the book is devoted to physical properties and forces, merging into chemical physics, which prepares the way for the course on pure chemistry that follows. "In the teaching of this portion of the work," says the author, "the exercises, illustrations, etc., have been selected to bear on the after-course and on chemical operations generally. Thus, in explaining porosity, filtration is illustrated and taught practically; the collecting and storing of gases, under impenetrability; the determination of boiling-points, fractional distillation, etc., under heat; the action of charcoal and dyeing, under adhesion, etc.; so that when the purely chemical portion of the work is reached the student will not be perplexed and impeded when reference has to be made to physical properties and physical forces. The principles are taught by experimental and arithmetical exercises and examination questions. Answers to many of the exercises are given at the end of the work." The book is suitable for students in colleges and high-schools. It is strange to see a work of this character without an index.

*The Lackawanna Institute of History and Science* has issued a first volume of its *Proceedings and Collections*. This society was organized in the winter of 1885–'86 at Scranton, Pa., for the promotion and diffusion of historic and scientific knowledge, especially that relating to the vicinity. The locality affords an exceptional amount of material for scientific study, for in addition to its fauna, flora, and minerals, it has the coal-measures with their wealth of fossils, and it lies within the area traversed by the ice of the glacial epoch. The present volume contains a lecture on "Glaciation: its Relations to the Lackawanna-Wyoming Region," delivered before the institute by John C. Brauner, Professor of Geology in the University of Indiana, and "A Preliminary List of the Vascular Plants of the Lackawanna and Wyoming Valleys," compiled by William R. Dudley, of Cornell University. Following these are the proceedings and by-laws of the society.

*Lessons in Geometry* is a small text-book by *G. A. Hill* (Ginn, 70 cents), prepared for those who desire a short and easy introductory course in geometry, adapted to pupils between the ages of twelve and sixteen. In these lessons large use is made of exercises in drawing to scale. The training in consecutive reasoning is introduced very gradually, and is confined mainly to the laws of equal triangles and a few of their simple applications. As here presented, geometry is intended to be studied before algebra. The contents of the book may form a course for two years or may be abridged so as to be covered in one year.

The first number of *Science and Photography* (Jas. W. Queen & Co., Philadelphia, $1 a year) has come to hand. It comprises articles bearing on various points in the practice of photography and a few papers on other scientific matters.

The *Annual Report of the State Geologist* of New Jersey for 1887 (*G. H. Cook*, State Geologist, New Brunswick) is only a business statement of the affairs of the survey, the near completion of the work making it unadvisable to go into detail as fully as has been the case in former annual reports. The first part of the final report may be expected in a short time. It will be upon the physical geography of New Jersey, and will embody in its texts the results of the geodetic, topographic, and magnetic surveys. The main work of the year was given to the completion of the topographical survey and maps of the State. Some field work was done in the exploration and study of the archæan rocks in Sussex County, examinations were made of the glacial and terrace deposits of the Delaware above the Water Gap, a careful and detailed survey was made of the zinc-mines of Franklin Furnace for the purpose of making a model of the vein, and attention was given to the questions of water-supply and drainage. A fine topographical map of the State by C. C. Vermeule accompanies the present volume. The survey and its documents are attracting increasing attention from citizens of the State.

*The Fifteenth Annual Report on the Geological and Natural History Survey of Minnesota*, by Prof. *N. H. Winchell* (Minneapolis, Minn.), has been issued. It covers the year 1886 and comprises a report by Prof. A. Winchell on the work of the party under his charge, a report by Prof. N. H. Winchell

largely taken up with the geology of the iron-bearing rocks of northern Minnesota, and several brief papers. The volume is illustrated with geological maps and many structural figures.

Dr. *M. E. Wadsworth* was in charge of a surveying party during a part of the summer of 1886, but devoted the rest of the season to laboratory work, the result of which is published as Bulletin No. 2 of the Minnesota survey, entitled *Preliminary Description of the Peridotytes, Gabbros, Diabases, and Andesytes of Minnesota.* The paper comprises general descriptions of the Minnesota rocks belonging to these groups, with a great many special descriptions of specimens collected in the northern part of the State.

Bulletin No. 4 of the survey is a *Synopsis of the Aphididæ of Minnesota*, prepared by *O. W. Oestlund.* A general description of the *Aphididæ* and a bibliography of the family are prefixed to the synopsis, and a list of North American plants with the names of species known to attack them is appended. The species of plant-lice treated in this paper were mostly collected along the Mississippi River; but the author has also added notes from other localities, so that he considers the report as applying to the whole State, except the pine district in the northern part.

A quarterly journal called *The Climatologist* began life with the number for January (P. O. Box 274, Washington; 50 cents a year). Its chief object will be to present information as to the climatic conditions of various regions and resorts with especial regard to their influence on the preservation of health and the cure of disease. Various sanitary subjects will also come within its scope.

The instructors, pupils, and friends of *Adam Todd Bruce*, Ph. D., have issued a quarto memorial volume containing his thesis entitled *Observations on the Embryology of Insects and Arachnids*, written for his examination for the degree of Ph. D. Prefixed to the thesis is a sketch of the scientific work of Dr. Bruce by Prof. W. K. Brooks. This young biologist graduated from the University of New Jersey in 1881. He obtained the degree of Ph. D. at the Johns Hopkins University in June, 1886, and was appointed an instructor there in September following. He died in March, 1887. The volume contains six plates illustrating the thesis and a portrait of the author.

*Inebriety: its Etiology, Pathology, Treatment, and Jurisprudence*, by *Norman Kerr*, a physician, whose titles and offices indicate that he is an expert in the study of the subject (Philadelphia, P. Blakiston, Son & Co.), has been prepared in response to numerous inquiries which have been addressed to the author regarding the best course to be adopted in dealing with the inebriate. The one common feature of most of these inquiries "has been the non-recognition of a disease element in inebriety, and the acknowledgment of only a moral depravity." Dr. Kerr takes an opposite view, and holds, with Dr. Crothers, of Hartford, that inebriety is a disease, in the face of which the victim is helpless, and that it can be cured only by suitable medical treatment and regimen. In elaboration of this view, he has prepared the present full, methodical treatise on the subject in all its aspects, illustrated with copious citations from his own and other professional experience and observation. The disease inebriety having been described as allied to insanity, five chapters are given to the consideration of its various forms; four to its etiology, with special studies of its predisposing and its exciting causes; two to its pathology; five to its treatment, which, as the disease is a complex one, is necessarily intricate, and is most successful in special homes where the surroundings can all be made favorable; and five to its medico-legal aspects. Under the last heading it is very evident that the legal treatment upon the theory that inebriety is a disease must be quite different from the present system, which regards it as a vice.

*The Journal of Physiology* (Cambridge Scientific Instrument Co., England) presents in No. 1 of Vol. IX three papers, with notes of proceedings. The first paper, by C. A. MacMunn, is "On the Chromatology of some British Sponges," and consists of examinations of the coloring matters in twelve species of sponge from Tenby. In ten of them he found chlorophyll, differing in no respect worth mentioning from vegetable chlorophyll; he also found lipochromes in nearly all, and a histohæmatin in seven. As to what use chlorophyll is to sponges, Dr. MacMunn suggests that it may sift out light-

rays of a certain wave-length to be utilized in the synthesis of the carbohydrates, etc. The second paper is by G. N. Stewart, and deals with "The Effect of Stimulation on the Polarization of Nerve," and the third is by W. Griffiths, "On the Rhythm of Muscular Response to Volitional Impulses in Man." The third paper presents comparisons of myograms taken from voluntarily contracting muscles, and the conclusions obtained with different muscles, different persons, different weights, different times of contraction, etc.

The second number of the *Journal of Morphology* (Ginn) contains five papers, viz.: "Oökinesis," by C. O. Whitman; "The Embryology of Petromyzon," by Dr. W. B. Scott; "A Contribution to the Embryology of the Lizard," by Dr. Henry Orr; "The Fœtal Membranes of the Marsupials," by Dr. H. F. Osborn; and "Some Observations on the Mental Powers of Spiders," by George W. and Elizabeth G. Peckham. The papers are illustrated with ten plates and several diagrams.

The first part of *Professor W. Preyer's* observations upon the development of *The Mind of the Child*, which relates to the senses and the will, has been translated for D. Appleton & Co.'s *International Education Series*, by *H. W. Brown*, of the State Normal School, at Worcester, Mass., an institution in which the students are taught themselves systematically to make and record observations upon the children whom they meet or come in contact with. The importance of the subject to teachers hardly needs enlarging upon; for it is obviously one of the most essential qualifications they should possess for their work that they should be acquainted with the nature of the object which they are to operate upon, whose continued development they are to aid. Of all the series of observations that have been recorded on the mind of the child, those of Professor Preyer have been probably the most thorough and systematic, and are described in the most lucid manner. He kept a complete diary of all childish acts and the acquisition of new powers from the birth of his son to the end of his third year; occupied himself with him at least three times a day, guarding him, as far as possible, against such training as children usually receive, and found nearly every day some fact of mental genesis to record. The substance of that diary has passed into this book. The record is enriched by notes of observations on other children and contributions from other persons. The whole forms a valuable foundation on which teachers may base their own individual studies, and a guide for the right conducting of them.

A paper on *European Schools of History and Politics*, read by Mr. *Andrew D. White* at the Johns Hopkins University in 1879, has been revised, and is published in the "Studies," edited by Prof. H. B. Adams. Although the editor puts only Mr. White's name on the title-page of the pamphlet, and runs the title of his paper as a heading over all the pages, scarcely half of the pamphlet is occupied by Mr. White's paper. The other contributions are "Modern History at Oxford," by W. J. Ashley; "Recent Impressions of the École Libre," by T. K. Worthington; and "Preparation for the Civil Service in German States," by L. Katzenstein, with a "List of Books upon the German Civil Service." Mr. White gives an account of the recent growth of the department of history and politics at some of the centers of European instruction, and then applies this European experience in discussing the need in our own country for men trained in these subjects.

In *Mary F. Hyde's Practical Lessons in the Use of English*, book two (D. C. Heath & Co.), the sound plan adopted in the former volume, of bringing only correct forms to the attention of the pupil, is adhered to. The exercises are a step more advanced in character than those of the former book, and are illustrated by selections from the works of Longfellow, Whittier, and Lucy Larcom. The aim observed throughout the work has been to lead the pupil to see for himself, to cultivate the powers of observation at every step; and, instead of discussing why certain forms are right and others wrong, to train him habitually to use the right expression.

D. C. Heath & Co. have added a second part of *Mrs. Julia McNair Wright's Seaside and Wayside* to the series of Nature Readers. It is substantially a continuation of the plan developed in the first part, and describes a

walk with the child-pupil by the sea-shore and along the road, with easy conversations concerning the nature, habits, life-history, etc., of the living creatures which the pair meet. These living creatures in the present volume are ants, earthworms, flies, beetles, barnacles, jelly-fish, starfish, and dragon-flies. The purpose is to lead the child by pleasant steps to the study of nature, and interest him in it. The talks are fitly illustrated.

*The Report of the New York State Superintendent of Public Instruction* for the year ending August, 1887, has been issued. The view of the condition of public education in the State, given by the Hon. A. S. Draper, the superintendent, is not characterized by that unalloyed complacency which pervades the generality of educational reports, but is a vigorous statement of what the schools of the State need for their further advancement. Among the special work of the year which he reports are the preparation of a new "Code of Public Instruction," the obtaining of a series of designs for school-houses, and an investigation in regard to compulsory education in other States and countries, made by Sherman Williams. The report on this investigation is printed with the superintendent's report. The usual statistics are given in the exhibits appended to the report.

The second "Monograph" of the Industrial Education Association (New York) is a brief paper on *Education in Bavaria*, by Sir *Philip Magnus*. It describes each kind of school maintained in that kingdom, and gives other general information on the organization of the Bavarian educational system.

No. 2 of *The American Journal of Psychology*, edited by Prof. *G. Stanley Hall* (N. Murray, $3 a year) contains an article on "The Relation of Neurology to Psychology," by Henry H. Donaldson, Ph. D., in which he summarizes certain recent advances in neurology, with a view to indicating what the field is and what some of the results are. There is also an article on "Insistent and Fixed Ideas," by Edward Cowles, M. D., which is illustrated by a detailed history of a complicated case of mental derangement. A paper by Joseph Jastrow, Ph. D., entitled "A Critique of Psycho-Physic Methods" deals with the methods and interpretation of such psycho-physic experiments as can be utilized for establishing Weber's law.

*The Heart of the Creeds*, or *Historical Religion in the Light of Modern Thought*, by *Arthur Wentworth Eaton* (G. P. Putnam's Sons), is an attempt to make clear the universal meaning in the rites and symbols of Christian faith, and to aid the believer in discriminating between what is necessary and what is accidental in religion. It is written from the orthodox point of view, and predominantly from that of the Protestant Episcopal Church. In this sense are considered the topics of "God," "Man," "Christ," "The Creeds," "The Bible," "The Church," "The Sacraments," "The Liturgy," and "The Future Life," each article being preceded, as in a sense of foretaste of what is to come, by a selection of terse expressions of thought on the subject by representative Christian writers of all ages.

G. P. Putnam's Sons have added to their series of "English History by Contemporary Writers," of which we have already noticed the first two volumes, *Simon of Montfort and his Cause*, by the *Rev. J. Hutton*, and *Strongbow's Conquest of Ireland*, by *Francis Pierrepont Barnard*. The former volume is made up chiefly of selections from the writings of Robert of Gloucester, Matthew Paris, and other contemporary chroniclers, and the latter from the works of Gerald of Barri and several other documents, including the Anglo-Norman poem on the conquest known as "Regan." This series is under the general editorial direction of Mr. F. York Powell, and aims at so setting forth the facts of English national history from contemporary documents, letters, and papers of all sorts, as to send the reader to the best original authorities, and at the same time to give a living picture of the effect produced upon each generation by the political, religious, social, and intellectual movements in which it took part, and thus to bring him as close as may be to the mind and feelings of the times he is reading about.

A work on finance, by *Dr. Luigi Cossa*, has been translated, and appears under the title *Taxation: its Principles and Methods* (Putnam, $1), with an introduction and notes by Horace White. It is essentially a volume of definitions and classifications, enumerating

in short paragraphs the kinds of public expenditure, the sources of public income, the forms of property on which taxes are laid, the varieties of public debt, and the ways of managing it. There is little discussion of policies in the body of the book, though the chief reasons for and against certain financial methods are briefly stated. Mr. White has, however, inserted discussions on taxation of mortgages, of personal property, of corporations, of land values, and taxation on consumption. Prof. Cossa's bibliography of the science of the finances is reproduced with additions, and compilations of the tax systems of New York and Pennsylvania are appended.

*The Modern Distributive Process*, by *John B. Clark* and *Franklin H. Giddings*, is composed of four articles, two by each author, contributed to the "Political Science Quarterly." The titles of the papers are "The Limits of Competition," "The Persistence of Competition," Profits under Modern Conditions," and "The Natural Rate of Wages." They are studies of the new conditions of the distribution of wealth resulting from the interference with competition caused by pools, trusts, labor unions, etc., and aim to show how much of the Ricardian theory of distribution persists in this new stage of economic evolution.

A fourth edition (revised) of *Constitutional History and Political Development of the United States*, by *Simon Sterne* (Putnam, $1.25), has just appeared. It is a popular work, consisting of "a sketch of the Constitution of the United States as it stands in text, and as it is interpreted by the Supreme Court, accompanied by a history of the political controversies which resulted in the formation of and changes in that instrument, together with the presentation of the actual situation of political parties and questions, which, in their turn, may produce constitutional changes." In the new edition, part of the book has been rewritten, and addenda have been supplied bringing the constitutional history and political changes of the nation from 1882 down to the end of 1887.

There are many persons who will be enabled to transact their business more securely by means of *Hints from a Lawyer*, a little manual by *Edgar A. Spencer* (Putnam, $1.25). Its object is to present the laws and methods relating to the care of property, the investment of money, the distribution of estates, and to marriage and divorce. It aims also to instruct the reader as to when the lawyer's counsel should be sought, and how such counsel can be best utilized. A large part of the text is in the form of questions such as a client would ask a lawyer, with the appropriate answers. It is adapted to all the States.

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Clark, Dr. Daniel. The Public and the Doctor in Relation to the Dipsomaniac. Toronto, Canada. Pp. 20.

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Cornell University. Bulletin of the Agricultural Experiment Station. Pp. 8.

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Foster, Rev. John O. Life Sketches and Speeches of Gen. Clinton B. Fisk. Chicago: Woman's Temperance Publication Association. Pp. 108, with portrait. 25 cents.

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Gilbert, C. K. Changes of Level of the Great Lakes. Pp. 12.

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Starr, Dr. Elmer, Buffalo, N. Y. Photographing the Interior of the Living Human Eye. Pp. 5.

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## POPULAR MISCELLANY.

**The Dynagraph.**—From a description of this instrument, which its inventor, Mr. P. H. Dudley, read before the New York Academy of Sciences, we select a few notes. The first dynagraph was made in 1874, and used paper eleven inches wide for its records. A later instrument uses paper of twenty or thirty inches width as desired. The recording apparatus occupies a floor space of about thirty-four by forty inches, in a car specially constructed for its use, and is thirty-seven inches high. It is placed over a special six-wheel truck, which carries many distinct sets of apparatus to furnish required indications, the results being electrically recorded by the battery of electro-magnetic pens on the recording apparatus. As the car moves, the paper is fed through the instrument, the rate when inspecting track being one inch of paper for each fifty feet of track. The apparatus may, if desired, take the dynamometrical curve, and inspect the track at the same time. From this curve, the number of foot-pounds of work expended in moving the train any selected distance is calculated. All movements of the cut-off, up or down, or of the throttle-valve, in or out, are shown by the curve. Aside from all other conditions, each engineer, especially on a freight-train, gives the curve a personal equation, a good one, if he is a first-class runner, thoroughly acquainted with the line, so he is able to work his locomotive to the best advantage, saving in fuel and time. Such engineers can draw more cars, with a given locomotive, than those who are not so well versed. One practical result of the use of the dynagraph was the discovery which has been verified in practice, that for freight-trains, on the Lake Shore and Michigan Southern Railroad, the locomotive gave a much more economical development of power running eighteen to twenty miles an hour, than when running ten to twelve miles. Further, the saving in running time of a train from Chicago to Buffalo was twenty-four hours, giving the road a much greater capacity with the same equipment. The track inspection includes the measurement of surface undulations and side deflections in the rails, the measurement of gradients, and of the curvature and alignment of the line. Lines are also traced showing the distance passed over, the time in seconds, side oscillations of car, the consumption of each cubic foot of water, and each twenty-five or fifty pounds of fuel, the velocity of wind, revolutions of drivers, intervals of firing, and duration of black smoke. Any special piece of electrical recording apparatus can be put in circuit with a pen, and its indications recorded. From the character of the delineations it is at once seen whether the rails are rough and bent, joints low, worn out, or loose on the ties, and whether any permanent improvement which can be made

by labor or new material is required. As the car runs over the track "low-point markers" eject paint under the heads of the rails where deflections occur, thus showing to trackmen where their labor is needed. Diagrams of track inspection have demonstrated that with sixty-five or sixty-seven pound rails the deflections were more than was generally supposed, and have led to the introduction of seventy-two and eighty pound rails.

**Systematic Reading for Teachers.**—Dr. Jerome Allen, of New York, gave, at the meeting of school superintendents held in Washington last year, a summary of the principles on which the teacher's systematic reading should be conducted. In the matter of primary knowledge as a teacher, he ought to read that which will most directly help him in the work of instruction. His pupils are human beings; he must know what they are, morally, mentally, and physically. He is especially set to train the mind; it follows, then, that he must study mind-growth and mind-science. How to train the mind into a symmetrical maturity is the most important knowledge a teacher can gain. All text-book knowledge is secondary in comparison with this. If a teacher knows all science, literature, and art, and does not know the mind and its growth, he is not prepared to teach. His work is empirical. The reading for secondary knowledge comprises methods of instruction, organization, school government, school systems, school laws, and the history of education.

**The Three Grades of Hand-Work.**—In a paper on "Sense and Hand-Training in Public Schools," Prof. Joseph Le Conte affirms that as drawing, if introduced, should be not for making artists, but for training the brain through eye and hand, so hand-work should be not for making carpenters or blacksmiths, but to train the brain by co-operation of hand and eye. If in biology the training is mainly of the brain through the senses, in hand-work the training is mainly of the brain through the hand. If one is mainly observing and thinking, the other is mainly thinking and doing. It is impossible to doubt the importance of hand-training from this point of view. All admit the absolute necessity of the use of the hand in the brain-culture of the child. All now admit also that the best scientific culture in the university requires the use of instruments of research—the microscope, telescope, the balance, the measures of force of many kinds. But in the whole wide space between, viz., in the school and the college, this great agent of culture is wholly left out. Now, I am quite sure that for every grade of culture, whether of the individual or of the race, there is a corresponding grade of hand-work necessary for the best brain-culture. In the child of pre-school age and in the savage and in paleolithic man, it is the simple use of the hand, or assisted by rude implements. In the school boy or girl, as also in the next higher grade of races, it is by the use of those finer instruments which we call tools. In the university, as in the most civilized races, it is by the use of scientific instruments and machines. The three grades of hand-work, then, are the use of implements, tools, and instruments. That especially adapted to the schools is the use of tools. But not only is hand-training in the schools an immediate and very urgent want, but by the necessary differentiation of human pursuits and the increasing divergence of school from actual life, is becoming more so every year.

**Perforated Stones from California.**—These objects are found abundantly in Southern California, varying in weight from an ounce, or even less, to several pounds. In shape they are most frequently circular, or nearly so, but occasionally they are irregularly oblong, and some are more or less globular, while others tend to the pear-shape. Mr. H. W. Henshaw states that by the surviving Indians of Santa Barbara and Ventura Counties the stones were formerly put to three uses: first, as weights to digging-sticks; second, as gaming implements; and third, as dies for fashioning tubes, pipes, and similar cylindrical objects. A Santa Barbara Indian, to whom a specimen was shown, a man sixty or more years of age, unhesitatingly affirmed, the moment he saw it, that it was a digging-stick weight. This implement, he said, was formerly in use among the women in his tribe. The stick must be strong and very hard; the wood usually employed grew only in the mountains. The especial function of the digging-stick was to dig a kind of onion-

like root. When in use, the weight was slipped over the handle till it rested at about the middle of the stick, like a collar. An old woman living in a village of the San Buenaventura Indians, thirty miles distant, corroborated the above statement as to the use of the stones. When one was put into her hands it at once excited her surprise and interest. In reply to the question, "What do you know of its use?" she instantly seized a small stick from the fireplace and slipped the ring down to its middle, holding it there with the left hand, and began to dig industriously into the dirt floor. From an intelligent half-breed of the same village, Mr. Henshaw learned that many of the stone disks were used in a game which was played as follows: A piece of level ground was selected for a court, and was made very smooth and hard. At one corner of the court was stationed a man whose business it was to cast the disks. The player, with a lance six or seven feet long in his hand, stood on one side of the court. Running a little distance, the bowler rolled a disk swiftly across the court, when the lance-thrower darted forward and cast his lance, the object being to transfix the disk as it rolled past. A successful throw counted one point, ten being the game. Dr. W. J. Hoffman was informed that at Santa Barbara the bow and arrow were in use in this game in place of the lance. The San Buenaventura half-breed stated that some of the perforated disks of hard stone were made for the express purpose of fashioning pipes. The end of the stone to be fashioned was inserted into the hole of a perforated stone and turned by the hand till reduced to the proper shape. The perforated stone hence served as a kind of die. Mr. Henshaw has found no evidence to show that these stones were used as net-sinkers, spindle-whorls, or club-heads.

**A Fatal "One Glass."**—A new book, called "Manners Makyth Man," gives a story told by a bishop of how he persuaded a man recovering from delirium tremens to become a teetotaler. "Years went by, and not a drop of intoxicating liquor entered his mouth. Six, seven, eight years passed, and his resolution remained unbroken. On the anniversary of the eighth sober year his friends, thinking the reformation complete, resolved to give a dinner in his honor. A family circle, rendered happy by the temperance of its head, received the congratulations of intimate friends. But it was a feast of deadly wine. Healths were proposed, and he who was being honored was told that to drink his own health in one glass could certainly do him no harm after totally abstaining for eight years. He drank the glass, and two years afterward I was called in to visit a poor drunkard who was on his death-bed by reason of that one 'friendly glass.'"

**Technical Education.**—In a paper on "Technical Education," G. S. Ramsay maintains that British workmen are not deficient in technical skill in any mechanical department, but, as a rule, distance those of most other nations. British work is inferior to foreign in two classes of departments: in those connected with processes requiring a scientific knowledge of chemistry of the highest kind, and in those in which success depends essentially upon taste, and upon the faculty of design. An instance under the former category is given in the manufacture of coal-tar dyes, which has been carried off from "under the very noses" of the British by the superior scientific skill and industrial capacity of another nation. British manufacturers furnish the material; Germans, under the direction of trained chemists, work it up, and sell back to the British the products in the form of beautiful colors and concentrated essences. Thus a works near Basle employs a chemist of comprehensive training and experience, three departmental chemists, and several assistants. Another one, near Frankfort, employs fifty-one scientific chemists. The manufacture of beet-sugar has been developed in Germany into a great trade by being treated as a scientific business, "to be carried on in strict obedience to the commands of scientific experts." In these operations the technical part of the work is made subordinate to the scientific principles on which it is based. British butter and cheese are being superseded in the markets by American and Canadian products, through the neglect of scientific improvements at home and the introduction of them in the competing countries. "In each of these cases," says Mr. Ramsay,

"we find the same state of things. The British producer fails to understand the importance of pure knowledge; he despises and disbelieves a knowledge of principles, and imagines that the only thing he need know is the application of those principles to his own particular work. In his eyes practice is everything, knowledge for its own sake, knowledge of principle, is nothing; as if there could be any value at all in practices unless he knows the reasons on which they rest. Our producers are like students who cram for an examination by getting up 'tips,' instead of getting up sound knowledge of the subject. The present cry for technical education is itself, to a large extent, only a new example, in an exaggerated form, of the same vicious idea. So far as it leads people to suppose that success in production or in life is to be gained from a knowledge of *technique*—of methods, of processes, of manipulation—instead of impressing upon them that all these are wholly unimportant and useless in comparision with a real education in the subject concerned, and a knowledge of the principles on which the *technique* is founded, its effect will be wholly bad. The idea that there are short practical cuts to just so much knowledge, and no more, as we need for the particular job in hand, is one which, if adopted, would demoralize our education to its root, as in diametrical opposition to the whole tenor of the evidence which has been collected in Germany and other countries."

**A Jadeite Adze from Mexico.**—Mr. George F. Kunz exhibited at the American Association a jadeite adze found at Oaxaca, Mexico, about twenty years ago, which was remarkable for its extraordinary size, and for the peculiar character and excellence of the working exhibited in so hard a material. It is 10⅛ inches long, 6 inches wide, 4⅝ inches thick, weighs 229·3 oz. troy, and is light grayish green, with streams of an almost emerald green on the back. In style of ornamentation it closely resembled a gigantic adze of granite which is mentioned by A. Chavero in his "Mexico al Través de los Siglos," and it has almost an exact counterpart in the aventurine quartz adze now forming a part of the Christy collection at the British Museum. It, however, differs from these objects in having no ornamentation on the forehead, and in having in addition three dull markings on each ear, one under each eye, and one near each hand, which could serve no other purpose than to hold thin flakes or films of gold, of which, however, no trace can now be seen. The adze is, from all appearance, the result of the shaping of a bowlder, for it presents evidences of weathered surfaces. The lapidary's work on this piece is perhaps equal to any that has ever been found, and the polish has not been surpassed. It is an interesting fact that, notwithstanding this adze is one of the finest objects which its Mexican owners possessed, they desired to "extend" the material; and for that purpose made three attempts to remove pieces from the object. Enough has been cut from the back of the adze to equal, perhaps, one eighth of the entire weight. The appearance of the cuts gives support to the supposition that the cutting was done with a string and some abrasive. The author had previously described in the "American Journal of Science" for July, 1882, a sapphire pebble found in a brook at Oaxaca. If the people were acquainted with this mineral, we can more readily understand how they were able to work so hard a substance as jadeite. So far as the author was able to understand, no similar object of such magnitude and equal archæological interest exists. The Humboldt celt, the Leyden plate, the Vienna adze, and the adze in the Ethnological Museum at Dresden, can hardly compare with it.

**The Name of America.**—Evidence is accumulating that the name of America is indigenous to our continent, and not borrowed from the name of an early navigator, as the world till now has supposed. M. Jules Marcou has found it in the name of a range of mountains in Central America—the Amerique range—and also in that of a tribe of Indians living upon it—the Ameriques. A more careful and thorough study of the subject has been made by Mr. "Thomas de St. Bris," whose pamphlet, *Discovery of the Origin of the Name of America*, can be obtained by addressing *P. O. Box No. 1852*, New York city, or from the American News Company. It appears from his investigations — the sources of which he names and are nearly

all to be found in the Astor Library and the American Geographical Society's maps and atlases—that the root of the name America was widely scattered over Central and South America at the time of the conquest. It appears in the kingdom of Amarca, Caxamarca (or Peru), in Amaraca on the west coast of Central America, and in the forms Cundin Amarca (Bogota), Tamaraqua, Amaracapand, Caxamaraca, Andamaraca, Catamarca, and many others, applied to various places, which are indicated on the maps with which the pamphlet is illustrated. As the authorities for these statements are fully described and easily accessible, students have ample opportunity for verifying or refuting Mr. St. Bris's theory. In further confirmation of these views, M. Marcou asserts that Vespucci's name was Alberico, or Albert, and never Amerigo, till he had returned from his American voyage and had adopted or been given a name commemorating his travels.

**Changes on the Zambesi.**—According to the observations of British Consul O'Neill, of Mozambique, the Zambesi River is working out important changes in its course near Maruru. About six miles south of the position of his camp was a long, swampy lake, which once formed the course of the river. Some obstruction in the bed of the stream deflected its course to the northward, and the old bed was left as a still lake or backwater, which is now filled only from its eastern extremity. This alteration has made great havoc on the northern bank of the river, where the rush of waters has torn and continues to tear away the country which separates the Zambesi from the Mutu and Barabango and other swampy depressions that drain into the Quaqua or Quillimane River. A little more than two years ago the African Lakes Company purchased a house at Maruru which stood eight hundred or one thousand yards from the river-bank. When Consul O'Neill visited the place in April, 1884, the river was running swiftly past the front walls of the house, the foundations of which it had already sapped. The front rooms had fallen in, and only the back part of the house was habitable. These changes are destined, of course, to make considerable changes in the delta of the Zambesi, and in the depth of channels now navigable. No improvement has taken place in the method of navigating the Zambesi, and no attempt has been made to improve it since it was first ridden upon more than three hundred years ago. Boats which will just do on a still-water canal, have to be forced against a powerful current, "at times with oars, at times with paddles, at times pulled along shore with the crew harnessed to a rope, not unfrequently swept into mid-stream by the strength of the current, and turned like a top."

**The American System of Water-Purification.**—As described by Prof. Albert R. Leeds, this comprises three distinct features: artificial aëration under pressure; precipitation of dirt, sewage, hardening constituents, and coloring matters by harmless precipitants; and mechanical filtration through filters capable of rapid reversal of current, and cleansing by mechanical means. Artificial aëration was first applied to a city water-supply, by Prof. Leeds, in Philadelphia, in consequence of an extremely offensive taste and odor developed in the Schuylkill water, in January and February, 1883. This treatment has produced a marked improvement, as shown by analysis, in the quality of the water of a number of cities which have employed it, has corrected the offensive taste and odor, and has stopped the growth of green scum in reservoirs. His reasons for advocating the use of air under pressure are, first, because the disagreeable taste and odor in unpotable water are frequently due to gaseous and volatile impurities, which can be largely swept out of the water by the use of an excess of air acting mechanically as a deodorizer and disinfectant, thereby exerting a sweetening action in the manner of a water-scrubber; and, second, because chemical and biological analyses show that where sewage is being broken up it is in presence of large numbers of bacteria, which grow and multiply upon this material. Through the vital processes of these bacteria oxygen is rapidly absorbed and carried to the sewage, which is thereby broken up into nitrites, nitrates, carbon dioxide, and other partly or wholly oxidized compounds. After the work of these microbes is completed, they either perish or remain as resting spores, and then they should be removed, together

with the products of their labors, by filtration. Assisted precipitation is employed to remove suspended matters in very fine particles, the dissolved salts which make water *hard*, and coloring matters, especially the peaty substances that produce a dark-yellow stain. Sulphate of aluminum, or the ammonium aluminum sulphate, which is common alum, has been found to be the best precipitant for the suspended substances, forming with them an insoluble coagulum. One grain of alum to the gallon is ordinarily sufficient, and this has no deleterious effect on the water. The insoluble clot which it forms carries down with it the products of putrescent decomposition which are present, and the microbes, or so-called disease-germs. For softening hard water, the precipitant used is lime, the lime carbonate thrown down being removed by filtration. The only material yet found to be available for filtration on a large scale is fine sand. In order to avoid the expense of the system of sand filtration, which has long been employed in England, a mechanical contrivance, called the National Filter, has been devised in this country. The filter consists of a closed tank, two thirds full of sand. The water enters at the top of the tank, filters downward, and escapes by a perforated pipe at the bottom. To clean the filter, a reverse current is sent in by a perforated pipe lying about a foot below the surface of the sand, most of the dirt being deposited in the upper six inches, and the water, after taking up the impurities, escapes by an outlet at the top. A reverse current is then sent through the sand by the perforated pipe at the bottom. Every portion of the bed is floated loose, and by the attrition of the grains of sand upon one another the impurities are scrubbed off; they are then floated to the top, and carried away. When the cleansing is complete, the reverse current is shut off, and the sand settles down into a fresh, uniform filter-bed.

**The English Glacial Moraine.**—Prof. H. Carvill Lewis's studies of the glacial terminal moraine of England were based upon the principle that every glacier, at the time of its greatest extension, is bounded and limited by a terminal moraine. The great ice-sheet which once covered northern England was found to be composed of a number of glaciers, each of which was bounded by its own lateral and terminal moraines. These glaciers were studied in detail, as the North Sea glacier, the Wensleydale glacier, the Stainmoor glacier, the Aire glacier, the Irish Sea glacier, the separate Welsh glaciers, each of which was found to be distinguished by characteristic bowlders, and to be defined by a well-marked moraine. The great terminal moraine of the united glaciers of England is a very sinuous line, five hundred and fifty miles in length, extending from the mouth of the Humber to the farthest extremity of Carnarvonshire; and, except where it separates the Welsh glaciers from the North Sea glacier, it everywhere marks the extreme limit of glaciation in England.

**The "High-Altitude" Cure for Consumption.**—In contemplating the resort to a high altitude for treatment of consumption, which is now becoming common, it is well to consider whether the constitution of the patient is adapted to the conditions that he will meet there. From the fact that the atmospheric rarefaction at elevated positions throws a greatly increased strain upon the circulatory apparatus, we have a right to regard valvular disease of the heart or feeble circulatory power as a strong contra-indication against trying the high-altitude treatment. For a similar reason that treatment is inapplicable to persons of advanced age, in whom the arteries are likely to have undergone more or less of senile degeneration. As the rarefaction of the air increases the number and depth of the respirations and promotes the elimination of carbonic acid from the lungs, it is not adapted to cases in which the lung-tissue has been much destroyed. Although superficial effusions of blood are sometimes suffered at great heights, bleeding at the lungs has not been observed there, and the danger of it is not believed to be increased. The prevalence of cold at high altitudes is a fact to be considered by persons whose sufferings are increased by low temperatures. The combination of cold, dryness, and rarefaction constitutes a climate of a highly stimulating character. It is consequently exciting, and unfavorable to nervous persons, while it may be beneficial to the phlegmatic. The cases

that do best at high altitudes are those of simple phthisis, in patients who are free from cardiac, renal, or rheumatic complications, and who exhibit a torpid reaction to the disease.

**Increasing the Tractive Power of Locomotives.**—Patents were granted in March to Elias E. Ries and Albert H. Henderson for methods and apparatus for increasing the tractive power of locomotives and other self-propelled rail vehicles. This is accomplished by increasing, by means of electricity, the frictional adhesion between the driving-wheels and the rails. The apparatus consists of a dynamo-electric machine on the locomotive, from which a current of electricity passes through a converter, and thence through the driving-wheels in succession and that portion of the rails between them. Further, the current, which is of great volume and small motive force, is said to cause enough heat at the point of contact to vaporize at once any moisture on the rails, thus overcoming the slipperiness caused by snow and sleet. The inventors claim that, by their plan, the tractive power can be nearly doubled without increasing the weight of the locomotive, that a 40-per-cent grade can be more easily surmounted than a 7-per-cent one under the old system, that trains can be stopped and started much more quickly than at present, and that the friction obtained is cheaper than sanding, without its consequent wear.

**An Exhibition of Insects.**—An exhibition of useful and injurious insects was held in Paris a short time ago, at which five hundred entries of objects were made. Great pains were taken to awaken interest in it. Prizes were offered to school-children for the best compositions on their visits to it. Conferences were held in the rooms on questions relating to the study of insects. Medals were offered to rural teachers who sent collections gathered by themselves or their pupils. Booksellers offered books to those who sent the best collections and the best papers on entomology. Anatomical preparations were shown by Dr. Ozouf representing the organization of the silk-worm in its several states and of May-bugs; silks from Tonkin and Senegal; oak silk-worms raised in the open air which furnish a silk identical with the Chinese pongee; living ant-hills collected by M. Morel, a journeyman painter; ant-lions which had excavated their dens in the sand as if they had been in the woods; batrachians, lizards, adders, aquatic insects, wasps building and repairing their nests, bee-hives with windows through which the bees could be seen at their work; wasps' nests from Senegal, remarkable for their excessive hardness; gall-nuts of various kinds, and collections from several countries, with illustrations of various features of insect life and economy.

**Construction of Mythologies.**—Closely connected as mythology and folk-lore are shown to have been, says Mr. J. A. Farrer, it is difficult or impossible to say in any given case whether the superstition is derived from the myth or the myth from the superstition. The usual method of interpretation deduces superstition from mythology, making the latter the primary starting-point. But it is often quite as likely that the custom was there first, and that the myth made use of already existing customs; for instance, that the horse figured conspicuously in legend because it had long been an object of worship or superstition, is as likely as that it became an object of worship or superstition because it figured so conspicuously in legend. The horse is thickly set in folk-lore. In parts of Germany a horse's head may still be seen over the doors of cattle-stalls or about the houses — a custom which survives among ourselves in the luck attaching to a horse's hoof. This, perhaps, dates from the custom of our ancestors, mentioned by Tacitus, of keeping white horses in sacred groves at the public expense and idle, and forecasting the future from their neighings. A horse's neighing always presaged victory to a warrior, as his silence presaged defeat, and the French anticipated disaster at Agincourt from the fact of their horses not neighing on the eve of the battle. A horse's hoof under a child's pillow is supposed to be a preventive from convulsions, a horse's teeth are a safeguard against toothache, and houses at which they shy are threatened with calamity. There is no reason to look for any more abstruse explanation for the part which animals, birds, fishes,

and insects play in the tales of the gods and heroes, than the fact that they were already accredited in popular superstition with the powers which they display in the stories. Seeing how many of the European peasantry still construct mythologies in an old-fashioned way, and cling to the old views in spite of science, we should have less difficulty in believing that the Greeks and Hindoos originally proceeded in the same fashion, without that constant reference to the struggle between light and darkness which some writers ascribe to them.

## NOTES.

THE Entomological Club of the American Association will meet at 9 A. M., August 15, 1888, in the High-School building in the city of Cleveland. As Cleveland is quite centrally located, this will be very convenient both for Canadian and United States entomologists. We may therefore expect an unusually large and interesting meeting. All who expect to present papers should send notice of their subjects to A. J. Cook, Secretary, Agricultural College, Mich.

THE meeting of the British Association is to be held at Bath, beginning September 5th. The sectional presidents will be Prof. Schuster in Mathematics, Prof. Tilden in Chemistry, Prof. Boyd Dawkins in Geology, Mr. Thiselton Dyer in Biology, Colonel Sir C. W. Wilson in Geography, Lord Bramwell in Economic Science and Statistics, Mr. W. H. Preece in Mechanical Science, and General Pitt-Rivers in Anthropology.

THE College of Engineering, of the Imperial University of Japan, graduated nineteen students in 1887—a number which the president thought, in view of the facilities for study offered, ought to be and would be much exceeded this year. There were four graduates from the College of Science. It appears that the people of Japan have not yet realized what promising careers are open to their young men in science. The small numbers which the scientific departments of the university are graduating are insufficient to meet the demands, which are increasing year by year, for the services of scientific men who shall further the national progress. Meanwhile, it is impossible to fill many vacant positions in the offices of the Imperial Government, and in various local governments and schools, where such graduates are needed.

DR. LUDWIG WOLF reports that the Baluba, of Central Africa, do not see any wrong in selling their wives and children, but that they make a difference between domestic slaves and slaves for export. A Baluba chief, with whom he expostulated, listened quietly to his arguments, and then told him, rather in confidence, that they sold only their troublesome wives out of the country, never the good ones. Dr. Wolf saw in the slave-market at Mukenge a distinguished-looking old fellow who had been a chief. During his reign he was continually fighting with the neighboring tribes, and many of his subjects were killed in battle. At last his people began to grumble, and decided quietly to sell their own chief into slavery, as the best way to get rid of him, and to live for the future in peace. They sold him for ten goats, which were killed, and the meat distributed as a compensation among the relatives of those who had died in the frequent battles of their chief.

MR. J. A. SCOTT, of Ann Arbor, Mich., has had a pleasant experience in tree cultivation during his life of eighty years. He can point to trees in Connecticut, now two feet in diameter, which he planted when a boy. His present home is shaded with a grove of maples which he planted. He allows squirrels to frequent the place, and encourages them to stay. They bring nuts, some of which find their way to the ground and grow; and thereby the maples are becoming interspersed with nut-bearing trees, which are already from six to twelve inches in diameter.

A CONTRIBUTOR to "Land and Water" mentions having shot in the Crimea bustards which came to the shore over the water from the southward, and alighted very weary. The circumstances indicated that they had flown across the Black Sea, and confirmation of this belief was given by finding in their crops a species of dwarf bean which was not known to grow nearer the Crimea than upon the hill-sides of Asia Minor, around Brusa, almost three hundred miles distant. He also took in the hand several quails, very much exhausted, which had apparently come direct from the sea.

EARTHQUAKE recorders have been so adjusted at the observatories in Japan as to give correct graphic representations of the movements undergone by a point on the soil during the progress of a shock. The resultant figure exhibits a series of twists and wriggles of the most complicated kind, so that the path pursued by the point might be, as it has been, compared to the form taken by a tangled string when thrown down in a heap. Prof. Sekiya, of the University of Tokio, has deciphered one of these tangles, and has made a model of seventy-two seconds of it in wire, in which the line of the curve of motion is distinctly designated for each second. The model, ten times the size of the graphic representation, is divided, to save confusion of the eye and mind of the student, into three sections, which are separately mounted, but fixed on a common table.

THERE are important differences in the quality of the virgin pine-wood of Michigan and the second-growth pine of Massachusetts. As shown by Mr. E. K. Lake, of Lansing, the virgin pine from Michigan is tough, and breaks splintering for three or four inches, while the second-growth wood from Massachusetts is more brittle and less fibrous, and breaks off short and even. The difference is ascribed to the more rapid vegetation, following the more direct exposure to the light, of the Massachusetts second growth; and also to the more perfect maturity of the Michigan pine—the specimen exhibited having been eighty years old when it was utilized, while the Massachusetts pine was cut at the age of forty years.

DR. GEORGE HARLEY, F. R. S., has made an investigation which reveals abundant evidence to prove that although man, during his evolution from barbarism to civilization, has increased in strength and stature and in longevity, on the other hand, his power of recovery from the effects of bodily hurt has materially deteriorated.

The existence and persistence of exclusively local customs—that is, of customs prevailing in a single village, without extending to those immediately around it—is a phenomenon for which explanation is still wanting. An instance of the kind has been marked at Wurzen, on the borders of Carniola, where, whenever there is a baptism, the nurse, on leaving the house to go to the church, takes a loaf of bread with her, and gives it to the first person whom the party meets. It is understood that the person to whom it is offered must take it whether he wants it or not. The custom is said to be symbolical, and to be intended to make the child charitable. But why has it been preserved here so long, while no other village has it?

A PRACTICABLE method of promoting forest growth is advocated by Mr. L. D. Watkins, of Michigan, by covering the waste places on the farm with trees. Besides making the land of use and being commercially valuable, they would serve a good immediate purpose as screens. The author recommends the common locust for steep hill-sides, where nothing else can be grown; black-walnut and white oak for such spots as may be fertile; and cedar and tamarack (larch) for damp, springy place.

THE reports of the British Meteorological Office show that the mean rainfall for the whole of the British Islands during 1887 was only 25·8 inches, whereas the mean for the twenty-two years from 1866 to 1887 was 35·3 inches. Thus there was a deficiency over the whole area of the country of nearly 10 inches, or 27 per cent.

DR. THORNE THORNE has called attention to the gradual decline of small-pox in England during the past fifty years. In the five years from 1838 to 1842, the deaths from this disease amounted to 57·2 per hundred thousand living, while in 1880–'84 the death-rate had sunk to 6·5 per hundred thousand. It is believed that vaccination has not only had a direct influence in causing this marvelous reduction in the number of victims to small-pox, but has also had a tendency to make the children of vaccinated parents less liable to the disease.

## OBITUARY NOTES.

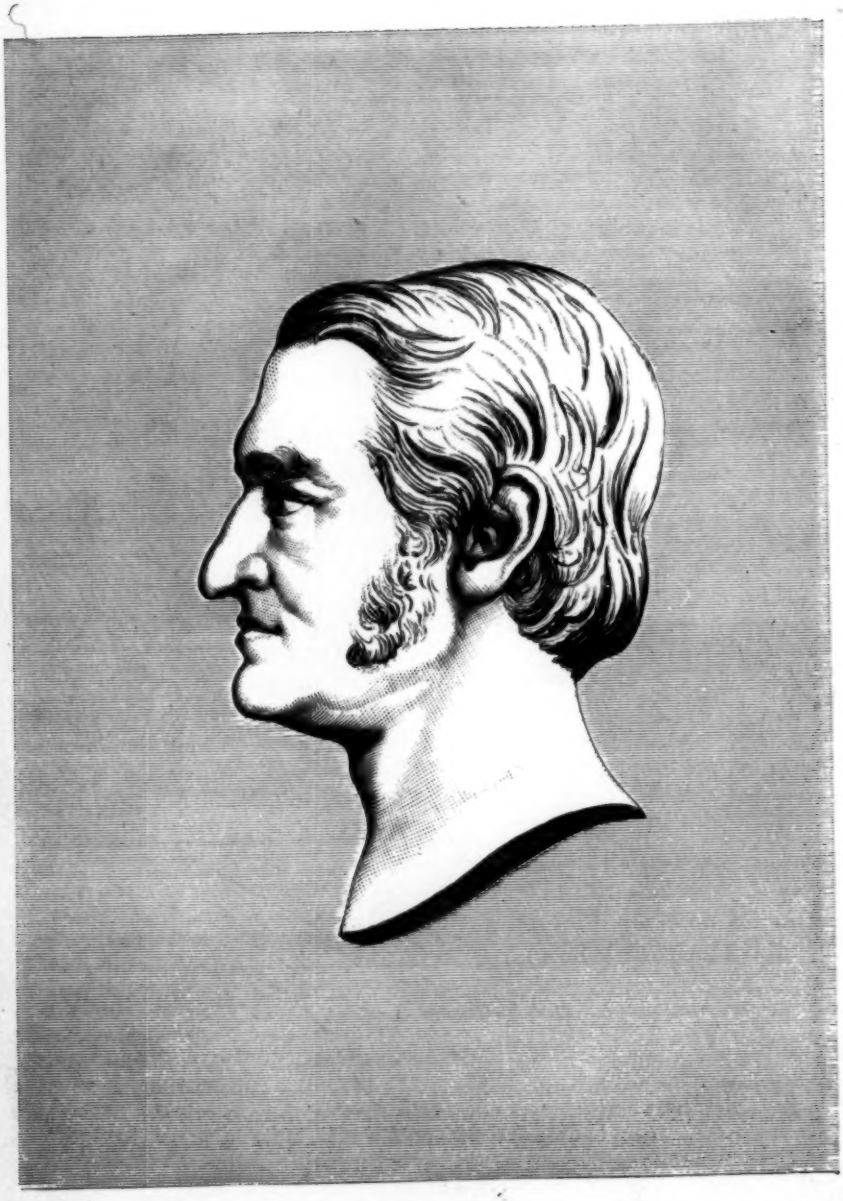
PROF. M. N. BOGDANOFF, an eminent Russian zoölogist, died at St. Petersburg, March 16th. He was the author of several works, relative to the animal life of different parts of Russia, in one of which he treated in detail the present geographical distribution of animals in connection with the soil and climate of the country during the Post-Pliocene period. His "Birds of the Caucasus" is the authority on that subject. In 1885 he began the publication of what was to have been his chief work, the "Ornithology of Russia." Only the first part of it has been issued. He was also the author of popular zoölogical sketches, published in a periodical.

V. N. MAINOFF, an eminent Russian ethnographer, has recently died. He was best known for his studies of the Mordvinians, their anthropological features and customs. He also prepared a Finnish grammar, and was compiling a Finnish and Russian dictionary.

JAMES JOHONNOT, a well-known laborer in education and author of educational books, died June 18th, at Tapton Springs, Florida, aged sixty-five years. His work in education was begun when he was eighteen years old, and was continued as teacher and institute instructor till 1885, and as author as long as his health permitted. Among his educational works, many of which were drawn from science, and in effect were first steps in it, are the "Principles and Practice of Teaching," the "Geographical Reader," the "Natural History Series of Instructive Reading Books," six in number; "How we Live," an elementary physiology; the "Historical Series of Instructive Reading Books," seven in number; and the "Sentence and Word-Book."

MR. HENRY PRYER, an authority on Japanese entomology and ornithology, died at Yokohama, February 17th. He was an old resident in Japan, and spent most of his time in business pursuits, while he also made a name in science.

PROF. R. D. IRVING, of the United States Geological Survey, died May 30th, in the forty-second year of his age. He had charge of the surveys in Wisconsin and Minnesota.



CARL FRIEDRICH GAUSS.